FISHER-ROSEMOUNT

RS3™

Service Quick Reference Guide

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Components of the RS3 distributed process control system may be protected by U.S. patent Nos. 4,243,931; 4,370,257; 4,581,734. Other Patents Pending.

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About This Manual

This manual is intended as an aid for service personnel supporting the RS3. It covers troubleshooting techniques, maintenance procedures, and data on virtually all of the hardware used with the system. This is a condensed quick reference manual. Full details are found in the *Site Preparation and Installation Manual* (SP) and in the *Service Manual* (SV).

The best way to find data on a specific device is to use the index. You can look up the device part number, device name, or the legend printed on the printed circuit board. The legends are shown in all capital letters in the index.

Another way to find a specific device is to scan the Table of Contents. This lists the contents of each page. Similar devices are grouped on a page with the devices listed in decreasing part number order. The device with the highest part number is listed first.

Section 1	Troubleshooting procedures.
Section 2	Maintenance procedures.
Section 3	Hardware data (LED meanings, test point meanings, jumper settings, and fuse values) for the power distribution system.
Section 4	Hardware data for the Twinax and Optical PeerWay.
Section 5	Hardware data for consoles and peripheral devices.
Section 6	Hardware data for ControlFiles.
Section 7	Hardware data for the Analog Card Cage and Multipoint I/O devices.
Section 8	Hardware data for PeerWay Interface devices such as the SCI, HIA, and RNI.

Changes for This Release

- Numerous corrections and minor revisions have been made throughout the manual.
- Many changes to this manual reflect hardware installation and service requirements for a new system power supply, the new RS3 Millennium Package (RMP), and the new MPC5 controller with 4 Meg NV Memory.

Revision Level for This Manual

This manual is independent of Software Release level. New equipment is added with each release and older material is updated. You should always use the latest version.

For This Software Version:	Refer to This Document:		
	Title	Date	Part Number
All	Service Quick Reference Guide	August 1998	10P57000201

References to Other Manuals

References to other RS3 user manuals list the manual, chapter, and sometimes the section as shown below.

Example Entries:

For ..., see CC: 3.

↑ ↑

Manual Title Chapter

For ..., see CC: 1-1.

↑ ↑

Manual Title Chapter-Section

Abbreviations of Manual Titles

AL = Alarm Messages

BA = ABC Batch

CB = ControlBlock Configuration

CC = Console Configuration

DT = Disk and Tape Functions

IO = I/O Block Configuration

OP = Operator's Guide

OV = System Overview and Glossary

PW = PeerWay Interfaces

RB = Rosemount Basic Language

RI = RNI Installation Guide

RP = RNI Programmer's Reference Manual

RR = RNI Release Notes

SP = Site Preparation and Installation

SV = Service

Reference Documents

Prerequisite Documents

You should be familiar with the information in the following documents before using this manual:

System Overview Manual and Glossary	1984-2640-21x0
Software Release Notes, Performance Series 1	10P56870106

Related Documents

You may find the following documents helpful when using this manual:

ABC Batch Software Manual	1984-2654-21x0
Alarm Messages Manual	1984-2657-19x1
ABC Batch Quick Reference Guide	1984-2818-1103
Configuration Quick Reference Guide	1984-2812-0808
Console Configuration Manual	1984-2643-21x0
ControlBlock Configuration Manual	1984-2646-21x0
I/O Block Configuration Manual	1984-2645-21x0
Operator's Guide	1984-2647-19x1
PeerWay Interfaces Manual	1984-2650-21x0
RNI Programmer's Reference Manual	1984-3356-03x1
RNI Release Notes and Installation Guide	1984-3357-02x3
Rosemount Basic Language Manual	1984-2653-21x0
Service Manual, Volume 1	10P569802x1
Service Manual, Volume 2	10P569802x2
Site Preparation and Installation Manual	10P569902x1
Software Discrepancies for Performance Series 1	10P56870304
User Manual Master Index	1984-2641-21x0

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Problem Reporting Terms

Please use the following set of terms when making a problem report. The terms have been defined in an attempt to reduce confusion in communication between users, System Support, and the development staff.

Definition of Terms

Term	Definition
Action	Tape loaded upon insertion in the drive. "Tape Auto Load" field active on the [CCC] screen.
Boot	To start up a device by loading a program from a storage device to a processor board.
Called Up	Define HOW you called up the screen. By use of: Loop Callup Button Command Line Next Option Select Other Button
Crash	The processor stops processing: Red LED on processor board All functions halted in the node Console clock not updating (console crash) Crash Dump Screen appears (68020 crash)
Create Boot Tape	The operation which initialized a tape, crates a console program on the tape, and backs up the disk files onto the tape.
Disk Backup	The process of copying all disk files onto the tape.
Disk File Backup	The operation that copies a file from disk to tape or to another disk.
Disk File Copy	The operation that copies a file from one disk to another.

(continued on next page)

Definition of Terms (continued)

Term	Definition
Disconnected PeerWay	Removed node from the PeerWay by: Physically disconnecting the Drop Cables Physically removing the PeerWay Buffer Card Use of the PeerWay Overview screen Use of the PeerWay Node screen
Folder Backup	The operation that copies a folder from disk to tape or to another disk.
Insert Tape	Physically placing the tape in the drive.
Loaded Tape	Tape Load: The software activity.
Manual Load	Tape was loaded by Disk Activity screen operation “Tape load”.

Troubleshooting the Power System

AC/DC Power Supply Troubleshooting

Condition	Action
PS FAULT (red LED) on. PS NORM (green LED) off. Amber AC IN lamp not on and no A/C is present.	1. Turn BATT ON/OFF switch OFF. Disconnect the DC power plug at supply. Voltage should measure between 28 and 34 volts DC. If not, replace the power supply. 2. Replace the battery charger board.
BATT TEST FAULT (red LED) on. **NOTE:** The power supply will continue to share the DC load without the battery or the battery charger board installed.	1. Wait 60 minutes and press the BATT TEST pushbutton. 2. Open the battery compartment and determine if the battery connections are OK. **NOTE:** If the batteries show any sign of leaking, such as white corrosion on the battery posts, replace the batteries. 3. Check the fuse that is next to the battery compartment inside the power supply. 4. Replace the battery charger board. Wait for 60 minutes and press the BATT TEST pushbutton. 5. Replace the batteries.

Troubleshooting a PeerWay

Three screens are useful in diagnosing PeerWay problems. See the Service manual, SV:10–1, for definitions of the screen fields.

Peerway Node Screen [PN] xx

This screen shows details for the named node (xx). Observe Qual A and Qual B, Noecho, Badecho, DupNode, AB Swap, and Coupler.

PeerWay Overview Screen [PO]

A dot indicates no errors, a number shows the number of errors, and ** indicates more than 99 errors. A vertical line of errors indicates a transmission problem, a horizontal line indicates a reception problem.

The A and B columns at the right side show each node's opinion of PeerWay A and B quality. Zero is perfect; 100 is a warning; and 500 shows very poor communication performance.

A node can be disconnected from PeerWay A by entering "A" at the prompt on the right. "B" disconnects the node from PeerWay B. "AB" disconnects both PeerWays.

The Actual margin should be between 495 and 505. A lower margin indicates a PeerWay B problem, a higher one indicates a PeerWay A problem.

Plant Status Screen [PS]

This screen shows the device at each node. Backlighting indicates ownership of the device by this console.

Diagnosing a Console or SCI PeerWay Problem

❑ **To diagnose a Console or SCI PeerWay problem:**

1. Move the drop cable from one tap connection to another.

CAUTION

When moving drop cables and PeerWay buffers from a ControlFile for troubleshooting purposes, make certain you move only those associated with the suspect PeerWay. If anything on the good PeerWay is disconnected, the ControlFile or console could be taken off the PeerWay.

Look at the PeerWay Node screen for this device, and note the “Noecho” and “Badecho” Fields. If the problem is now cleared, replace the Tap Box at the earliest convenience. If all of the tap connections are used, swap two drop cables at the Tap Box. Determine if the problem moves to the node that was swapped. If the problem moved, replace the Tap Box.

2. Replace the Console PeerWay Interface Card.
3. Replace the Console Power Regulator Card.
4. Replace the drop cable.
5. Command Console and Basic Command Console only: Pull the console card cage out and connect the drop cable directly to the back of the motherboard, bypassing the short marshaling panel cable. Use extreme caution when removing and installing the console card cage to avoid damaging any cables.

Diagnosing a ControlFile PeerWay Problem

The procedure for checking PeerWay problems differs if there is one ControlFile or several ControlFiles on the PeerWay.

❑ **To diagnose a ControlFile PeerWay problem with one ControlFile on the PeerWay:**

1. Move the drop cable from one tap connection to another.

WARNING

When moving drop cables and PeerWay buffers from a ControlFile for troubleshooting purposes, make certain you move only those associated with the suspect PeerWay. If anything on the good PeerWay is disconnected, the ControlFile or console could be taken off the PeerWay.

Look at the PeerWay Node screen for this device, and note the "Noecho" and "Badecho" Fields on this screen. If the problem is now cleared, replace the Tap Box. If all of the tap connections are used, swap two drop cables at the Tap Box. Determine if the problem moves to the node that was swapped. If the problem moved, replace the Tap Box.

2. Remove the PeerWay Buffer card from the ControlFile on the faulty PeerWay. Follow step a or b below depending on the part number of the card.
   a. Part number 1984-1402-0003: The card must be replaced to determine if it is bad. If no spares are available, the card can be swapped with the other buffer in this cage. This will take the node off of the PeerWay.
   b. Part number 1984-1502-0001: Remove the card and move the seven jumpers (HD 2, 3, 4, 5, 6, 7, and 8) on the card to the TEST position. Install the card and look at the PeerWay Node screen and determine if the Noecho and Badecho Fields are at 0. If they are now at 0, the PeerWay Buffer Card is bad and must be replaced.

WARNING

If the Coordinator Processor Card is disabled on a running process, all operator process changes, links running between controllers in that cage, and links to and from that ControlFile will freeze at the last value received. The controllers will continue to operate the process under these conditions. As soon as the Coordinator Processor Card is restarted all links will be updated.

3. Replace the Coordinator Processor Card.

If there are several ControlFiles on the PeerWay, use the following procedure.

❑ **To diagnose a ControlFile PeerWay problem with multiple ControlFiles on the PeerWay:**

1. Move the drop cable from one tap connection to another.

WARNING

When moving drop cables and PeerWay Buffer Cards from a ControlFile for troubleshooting purposes, make certain you move only those cards and cables associated with the suspect PeerWay. If anything on the good PeerWay is disconnected, the ControlFile could be taken off the PeerWay.

2. Look at the PeerWay Node screen from the Tap Box, and note the "Noecho" and "Badecho" Fields on the screen. If the problem is now cleared, replace the Tap Box at your earliest convenience. If all of the tap connections are used, swap two drop cables at the Tap Box. Determine if the problem moves to the node that was swapped. If the problem moved, replace the Tap Box.
3. Swap the PeerWay Buffer Card from this node's bad PeerWay with a PeerWay Buffer Card from the same PeerWay of another ControlFile. If the problem moves, replace the PeerWay Buffer Card.

WARNING

If the Coordinator Processor Card is disabled on a running process, all operator process changes, links running between controllers in that cage, and links to and from that ControlFile will freeze at the last value received. The controllers will continue to operate the process under these conditions. As soon as the Coordinator Processor Card is restarted all links will be updated.

4. If the problem does not move to the other ControlFile in step 3, replace the Coordinator Processor Card in the suspect card cage.

Troubleshooting Twinax PeerWay Cables

❑ **To diagnose a twinax PeerWay cable problem:**

1. Check all twinax cable connections for proper seating on the Tap Boxes.
2. Check that both ends of the PeerWay are properly terminated.
3. Check for multiple grounds. Only one Tap Box on each PeerWay (A and B) can have the jumper in the “SHIELD” position.
4. Check to make sure that all twinax cable connectors are isolated from ground.
5. Remove the “T” connector from the Tap Box, keeping the two twinax cables connected to the “T” connector.

NOTE: The “Force Margin” field on the Peerway Overview screen should show “None”.

Use an ohmmeter to measure the following resistances:

a. Between 1 and 2: 50 ohms nominal (acceptable range: 45 to 70 ohms)

b. Between 1 and shield: resistance greater than 1 megohm

c. Between 2 and shield: resistance greater than 1 megohm.

If the resistance between 1 and 2 is 100 ohms or greater (or in extended length cable, 124 ohms or greater), there is a break in one of the twinax cable segments. Disconnect the two twinax cables from the “T” and measure between 1 and 2 of both cable ends. The reading should be between 100 and 140 ohms. Follow the faulty cable back until the open is located. Terminations at both ends should read 100 or 124 ohms.

If the resistance between 1 and shield or between 2 and shield measures less then 1 megohm, this indicates a short between one of the lines and the shield. Disconnect the two twinax cables from the “T” connector and measure each cable to find the faulty end. Continue following the cable segments until the fault is found.

General Console Troubleshooting Procedures

❑ **To diagnose Console problems:**

1. Load from boot tape. If the console loads OK, replace the hard disk drive.

NOTE: Use a tape made from the “Create Boot Tape” function. To load from tape, insert the boot tape and power up the console. Hold [HDWR ALARM] throughout the Hardware Power Up Diagnostics screen until the console indicates loading from the streaming tape. After the console displays the Main Menu, enter [DISK DIRECTORY PEERWAY], cursor to the “TAPE” field, and press [ENTER]. Then perform the “Restore Tape Files to Disk” function. Cycle DC power and try to load using the Winchester disk. If the console still will not boot from the hard disk, replace the disk drive assembly. For the Enhanced or Standard Engineering Keyboard (1984-1654-000x): Hold the “H” key in place of [HDWR ALARM].

2. If the console will not load from tape, replace the SCSI interface card.

NOTE: Do not replace a SCSI Interface card with a Disk Interface card.

Console Power-Up Diagnostics

When power is applied to a console, the console is put through a series of comprehensive tests to verify console card operation.

If a failure occurs on any one of the console cards, the word “PASSED” is replaced with “FAILED” or “MISSING”. The console will then finish the power-up tests, and an alarm at the bottom of the screen will indicate “CRITICAL FAULTY OR MISSING”. If any card is indicated as missing, the card has failed to the point that it cannot be detected in the card cage and the console will not run. If a card indicates “FAILED”, the test that failed will be backlit in red and the console may still be able to run, depending on the fault of the card. Pressing [ACK] on the Loop Control Panel or the red [ALARM ACK] button on the Operator Keyboard will attempt the system boot. Before pressing [ACK], note which card and the specific test that failed for future reference.

NOTE: For the Enhanced Engineering Keyboard (1984–1654–000x): The red ACK key is not recognized until the console has finished booting. Press the “A” key or “F10” to acknowledge the alarm.

Console Power-Up Tests

Item	Test	Definition
Console	Bus/Interrupt Test	This is a test of the processor card ability to talk to the other cards on an interrupt level. A failure here could indicate that the processor card is bad or one of the other cards in the console could be affecting the test. The power should be turned off to the console and all cards but the power supply and processor removed. The front panel keyboard cable should also be removed. The console should again be turned on and, after 30 seconds, the green LED on the processor card should turn on, indicating the card passed all tests. The rest of the cards should then be added one by one until the fault again appears and that card should be replaced.

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Console Power-Up Tests (continued)

Item	Test	Definition
Console (cont.)	EDAC Test	This is a test of the Error Detection and Correction circuitry. An error is purposely written into a number of RAM addresses to verify that the EDAC will correct it. If the card has failed the EDAC test and passed the RAM test there should be no fault that would corrupt data. The card should operate for a period of time but could reset the console frequently. The processor card should be replaced as soon as possible.
	Four Meg RAM Test	An address and data test is run on all of the RAM on the processor card. If a failure is indicated here the console will probably not run reliably. **NOTE:** If a single bit error is detected during the RAM test, the Error Detection and Correction (EDAC) circuit will correct for a single RAM chip failure. The EDAC test on the processor card will be bypassed (indicated by the EDAC test also being backlit) and the console will not halt on this screen but will start up from disk in the normal way. A “Console Weak RAM Chip,bit XX” alarm will be generated and placed on the Active Alarm List.
	Instruction Set Test	This is a test of the microprocessor itself. An elaborate algorithm is run using many of the varied instructions to verify the integrity of the microprocessor. If a failure is indicated here, the processor may be bad and the card should be replaced. Power regulator voltage should also be checked.
	Processor Boot Version	This number indicates the software revision number of the ROM memory parts of the processor card. The ROM contains the information that the processor needs to run the power-up diagnostics and the routine needed to load the Boot Disk into the console in order to begin operating.

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Console Power-Up Tests (continued)

Item	Test	Definition
Console (cont.)	ROM Test	A test of the integrity of the boot ROMs on the processor card that instruct the processor on how to run the power up diagnostics. If a failure is indicated here and the acknowledge button will start up the console, the failure will not affect the operation of the console once it is running. The boot ROMs are only used during start up. The online test of the ROM (MCT Screen) may also indicate test failures.
	SR Test	SRAM test. If a fault is indicated here the card should be replaced.
	Watch Dog Timer	The watch dog circuit is allowed to time out and reset the microprocessor to verify its operation. The card will operate if the watch dog circuit is not functioning. However, the card should be replaced as soon as possible or, if a fault does appear, the card may not reset in the case of a bad instruction.
Keyboard	All Lamps on for Visual Check	All the LEDs on the Loop Callup Panel are turned on to verify that they are all working.
	Display Panel	The panel is asked for the firmware revision number. The response is checked for correct format and checksum. The firmware level is displayed on the screen. If there is no response, the panel is assumed not installed.
	Keyboard Interface	Same as Display panel.
	Option Panel	Same as Display panel.
	Trackball	Same as Display panel.
	TTY Keyboard	This indicates that the null character was not received from the keyboard microprocessor by the console processor. A fault here could indicate a bad TTY Keyboard, a disconnected keyboard cable or a bad cable connection on the console motherboard. **NOTE:** If the cable between the motherboard and the Loop Callup Panel is disconnected, the console will show a fault yet would also load the disk. The console screen then locks up showing the date, time, and an alarm at the bottom of the screen with no menu.

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Console Power-Up Tests (continued)

Item	Test	Definition
PeerWay	Jabber Halt	A circuit on the card is intended to keep a faulty node from transmitting too long on the PeerWay. If this test indicates a fault, the card may operate, but should be replaced as soon as possible.
	Local Loop Back	This is a test of the console ability to hear its own echo through the PeerWay system. If a failure is indicated here, this indicates that the console is not working on one or both PeerWays. The Tap Box could be faulty, drop cables could be disconnected, or the PeerWay Interface card could be bad.
	RAM Test #1	This is a data test of the RAM on the card. The card should be replaced if a fault is indicated.
	RAM Test #2	This is an addressing test of the RAM. The card should be replaced if a fault is indicated.
	Register Check	This is a check of the several chips on the card. If this test indicates a fault, the card should be replaced.
Power Supply	+5 V and +12 V	A voltage sense circuit is read and if the +5 or +12 volt supply on the power supply card is not in tolerance, the voltage will be backlit. The power supply should be replaced.
	A: +30 and B: +30	The voltage sense on the incoming DC bus is monitored and, if one of them is below approximately 18 volts, the indication will show a fault. However, many consoles use only one DC bus for power so the card fault will not indicate “FAILED”.
Printer	NVRAM Test	A checksum is run on the data in NVRAM. If the checksum is incorrect, the test will indicate a fault. The system will run if this is showing a fault, but some of the console configuration could be corrupt. The online NVRAM checksum test should also be checked on the Menu Confidence Test screen.
	Periodic Interrupt	This is a test of the interrupt system generated off the clock. If this test indicates a fault, the card should be replaced.

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Console Power-Up Tests (continued)

Item	Test	Definition
Printer (cont.)	Printer Ready	This indicates if the printer is present and on line. If the printer is not connected, it will not cause the diagnostic screen to lock up, but printer indication will be backlit, indicating no printer is connected.
	RTC	The operation of the Real Time Clock is tested. If a fault is indicated, the card should be replaced.
	RTC Battery	This indicates the state of the charge on the batteries used to back up the Real Time Clock. If a fault is indicated, the battery charge is low or the battery jumper switch is in the off position. The battery status is also monitored on the MCT screen.
SCSI Board (MTCC) Disk Drive (MC and BCC)	DMA Registers	The registers of several of the devices on the card are tested to verify operation of the board. If a fault is indicated here, the console may not boot up from disk. If it does, operation can be attempted, but the card should be replaced as soon as possible.
	RAM Test #1	This is a data test of the RAM on the Disk Interface card. If a fault is indicated here, the card should be replaced.
	RAM Test #2	This is an addressing test of the RAM on the Disk Interface card. If a fault is indicated here, the card should be replaced.
	SCSI Controller	This test checks the registers of the specialized SCSI interface bus devices for proper power up conditions.
	SCSI Master	This indicates which console is the SCSI master.

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Console Power-Up Tests (continued)

Item	Test	Definition
Video Generator	Color Test	Tests for shorts between the RGB lines. An error could be a board fault or a cable fault.
	DAC Test	Test of the Digital to analog Converter which measures voltages on the RGB output lines to the monitor. An error here can indicate that a video driver has failed so the card must be replaced. It could also indicate that the monitor is not properly terminated, the video cables are damaged, that the shields are shorted to ground, or the type of cable is wrong.
	PIT Test	Test of the Parallel Interface Timer which is used to control interrupts. If a fault is indicated the Video Generator card should be replaced.
	RAM Test	Addressing and data test is run on the RAM in the Video Generator. If a fault is indicated here the card should be replaced.
	Synch Test	Tests synch signal rates. If a fault is indicated the Video Generator card should be replaced.
	Tape Drive	Test to check for the presence of the tape drive SCSI controller board and checks for tape ready signal. If no tape is installed the tape indication will be backlit blue. If a tape is present, it will rewind the tape. **NOTE:** If the cable between SCSI controller card located on the tape unit and the tape unit is disconnected, this test will not indicate a fault without a tape installed. This can be verified by installing a tape in the unit and the tape test should not be in the blue color.
	Winchester	Tests to check for disk ready signal, and verifies the integrity of several sections of the disk to make sure it works properly. **NOTE:** If the cable between the SCSI controller card located on the disk unit and the disk unit is not connected, both the disk and tape unit will indicate fault by being backlit in red.

Console Off-Line Diagnostics

Off-line diagnostics for the console are loaded from tape or floppy disk depending on the console in use. Tests are the same with the exception of the keyboard tests which are suited to the individual console.

❑ **To run the off-line diagnostics:**

1. For a Command Console, insert the appropriate Off-Line Diagnostics tape in the console tape drive, turn the console power off for 30 seconds and then back on. Hold down the “Hardware Alarm” button during the power-up diagnostics until the console indicates it is “Booting From Streaming Tape”. This boots the console and brings up the Off-Line Diagnostic Menu.

   For a MiniConsole or Basic Command Console, insert the appropriate Off-Line Diagnostics disk in either disk drive, turn off the console power for 30 seconds and then back on. This boots the console and brings up the Off-Line Diagnostic Menu.

2. Check the Power-Up Diagnostic screen for any faults.
3. Run desired tests.

Console Off Line Diagnostic Menu Definitions

Item	**Test**	Definition
Revision No.		This indicates the software revision of the Off-line Diagnostics test disk being used.
Processor Card	1. Processor RAM Test	This is a thorough address and data test of all of the RAM on the card. The test takes approximately 4 minutes and runs indefinitely unless stopped by pressing the [CTL] and [C] buttons together (Control C function) or power to the MiniConsole is shut off.
	2. Processor ROM Test	A checksum test is run on the boot ROMs on the Processor card. The test is run very rapidly and will run indefinitely unless halted by a Control C function.
	3. Reset System – Power-up Test	This function will force the MiniConsole to go through the power-up test and reboot from disk.
	4. Processor RAM Test	This is a thorough address and data test of all of the SRAM on the card.
Printer Interface	5. NVRAM Test	This is a nondestructive test of the nonvolatile RAM on the Printer Interface card. The test must be allowed to run up to 8192 before the test is complete. Any write errors will be reported.
	6. Clear NVRAM	This is a destructive test of the nonvolatile RAM on the Printer Interface card. It will write all zeros to the NVRAM. Any write errors will be reported. The NVRAM must be reloaded from the disk Console Configuration file.

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Console Off Line Diagnostic Menu Definitions (continued)

Item	**Test**	Definition
Printer Interface (cont.)	7. Printer Port Loopback Test	This initiates a test of the circuitry to drive the printer. Before starting the test the Printer Interface card must be removed and jumpers HD 7, HD 8, and HD 9 must be moved to the test position and jumpers HD 1 through 6 should be removed. NOTE: All tests except the Printer Barber Pole test can be run with the jumpers in this position.
	8. Printer Barber Pole	This test outputs a barber pole printer pattern for testing the printer. The printer must be set up for 9600 baud.
Video Generator	9. Color Palette RAM Test	This tests the color palette.
	10. Video RAM Test	16 pages can be written into the Video RAM. During the test, patterns are written to each page of the Video RAM.
	11. Video Convergence Pattern	This generates a test pattern to enable checking the CRT for alignment and linearity. No test results are given.
	12. Alarm Contacts Test	Tests the alarm contacts.
Keyboard Assemblies	13. Command Entry Keyboard Test	This test allows for the testing the Main Operator Keyboard Keys. All keys are pictured on the screen and each key picture will light when the corresponding key is pushed.
	14. TTY/ASCII Keyboard Test	This test allows for the testing part of the individual TTY keys. All keys are pictured on the screen and each key picture will light when the corresponding key is pushed.

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Console Off Line Diagnostic Menu Definitions (continued)

Item	**Test**	Definition
Keyboard Assemblies (cont.)	15. Old TTY Cursor/numeric Keys Test	This test is used to test the Cursor/Numeric keys of the old configuration keyboard.
	16. New TTY Cursor/numeric Keys Test	This test is used to test the Cursor/Numeric keys of the new configuration keyboard.
	17. MTO Cursor/Numeric Keys Test	This test is used to test the Cursor/Numeric keys of the enhanced keyboard.
	18. Loop Callup Keyboard Test	This test allows for the testing the individual Loop Callup keys. All keys are pictured on the screen and each key picture will light when the corresponding key is pushed.
	19. Trackball Keyboard Test	This tests the trackball.
	20. Keyswitch Test	This test allows for the testing of the Key Switch. Each key can be inserted in the key switch and the key number seen by the system is reported on the screen.
	21. Panel Light Test	This test lights all the panel LEDs in single sequence and then in rows. It is used to verify all LEDs are working and no shorts exist between lights.
Floppy Utilities	22. Winchester Disk Exerciser	This test reads and writes to the hard disk to determine if there is a hardware problem or a media problem. This test will destroy all information on the disk.
	23. Winchester Formatter	This test destroys all information on the disk and formats the disk.

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Console Off Line Diagnostic Menu Definitions (continued)

Item	**Test**	Definition
Floppy Utilities (cont.)	24. Tape Tests	This brings up a tape test menu which allows the user to choose between the following tests to be performed on the tape drive: Retension Tape Erase Tape Tester/Exerciser Disk Copy Compare Tape Copy Unload Tape These tests can be used to test the tape drive. CAUTION: "Erase Tape" and "Tester/Exerciser" will destroy all information on the tape.
	25. Floppy Disk Exerciser	This test performs reads and writes to the floppy disk drive to determine if there are any drive problems. This test will destroy all information on the disk.
	26. Floppy Formatter	This test destroys all information on the disk and formats the disk.
PeerWay Interface Card	27. PeerWay Interface Card test	Runs these tests on the PeerWay Interface Card: RAM Test #1 RAM Test #2 Jabber-Halt Local Loop Back

Console Crash Dump Screen

This screen is intended to trap software errors and may appear because of faulty processor RAM or other hardware faults or software problems. If this screen appears, note which function was being performed when the screen appeared and make a screen print. If you are unable to get a printout of the screen, copy down all the items highlighted in the figure.

- Screen Title
- Time
- System Error Trap Number.....SR Number.....PC Number.....
- All of the lines of the System Stack
- All of the lines of the User Stack

It is also important to note which software revision levels are being run at the time of the crash.

If the console locks up repeatedly, perform the Off Line Diagnostics on the processor card ROM, disk or SCSI RAM, and Video Generator RAM.

Memory Dump

The memory dump helps service personnel diagnose software problems. A node's RAM memory can be captured and viewed or saved to a file. The contents of RAM memory can often be used to help solve difficult software problems. Disk event messages are generated as the result of memory dump activities.

- The memory dump can only be performed on consoles, CPs, and SRUs.
- The node must be active. If the PeerWay Node screen is functioning, the node is active.
- A memory dump can only be performed on 68020 consoles running Version 15 or higher.

❑ **To make a memory dump of a node:**

1. Cursor to the command line. Type:

   MD (*node #*) **,** (*filename*) [ENTER]

2. The memory of the specified node is put into the specified file in the Log Files folder. The file is of the type Memory Dump.

   The memory dump is performed in the background and may take a few minutes to complete. You can perform other tasks while the dump is occurring.

❑ **To stop a memory dump before it is finished:**

1. Cursor to the command line. Type:

   KMD [ENTER]

Memory View Screen

The Memory View screen has been added to allow you to view the contents of a memory dump file or the current contents of memory. The screen is only available with 68020 pixel consoles.

❑ **To read current memory data from a node:**

1. Call up the Memory View screen.

   MV [ENTER]

2. If you want to look at a node other than the one you are at, change the “Node” field entry.

❑ **To read memory data from a file:**

1. Call up the Memory View screen.

   MV [ENTER]

2. Cursor to the “Memory” field and press [ENTER]. The field changes to “File”.
3. Enter the “Volume”, “File Type”, and “Filename” of the file that contains the memory data.
4. Cursor to the “Read” field and press [ENTER].
5. To access other screens to see more memory data:

   [PAGE AHEAD] and [PAGE BACK]

Memory View Screen Field Description

Field	Description
Addr	Specifies the starting address of the memory data displayed on the screen.
Decimal/Hex	Specifies that addresses are shown in decimal or hexadecimal. To change this field, press [ENTER].
File/Memory	Specifies that the memory data is being read from a file or directly from the node. You can change this field by pressing [ENTER].
File Type	Specifies the type of folder that contains the file you want to view. For memory dumps, the type should be “Log File”.

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Memory View Screen Field Description (continued)

Field	Description
Filename	Specifies the name of the file that contains the memory data.
Hex/Decimal	See the “Decimal/Hex” field.
Memory/File	See the “File/Memory“ field.
Node	Specifies the node number of the source of the memory data.
Read	Reads the current memory data onto the screen, or reads data from a file. Press [ENTER] to read new data. The Memory View screen takes a snapshot of memory. This field allows you to refresh the screen with the current contents of memory.
View	Specifies how the data is interpreted and displayed. Byte =2 hex character groups Char =2 hex character groups Float =Floating point numbers Link =Link addresses Long =8 hex character groups Short =4 hex character groups Time =System time
Volume	Specifies the name of the volume that contains the memory data file.

Node Dump Screen

The Node Dump screen shows details after a crash of a console or ControlFile. Enter **ND** nn where nn is the node number.

Menu Confidence Screen

The Menu Confidence screen allows you to view the status of console power, the status and results of ongoing RAM and ROM tests, and the battery jumper position. Enter **MCT** to call up the screen. You may boot the console by cursoring to “Power Up Test” and pressing [SELECT]. You can also configure the console to play a tune on boot up by changing the “Startup Tune” parameter.

Keyboard Problems

A locked keyboard may be reset by holding down [CTRL], [ALT], and [INSERT] simultaneously.

The console will report bad keys (shorted or excessive length keystroke) by the message “Keyboard Error X:XX” where the first X represents the keyboard number and the XX represents the key.

The numbers for the keyboards keys depend on the type of console.

CRT Problems

If there are problems with the CRT, a quick way to test whether it is the monitor or the video source is to connect another monitor to the video cables. Another trick is to connect the video cables to another OI Card Cage.

Troubleshooting OI Card Cage Problems

NOTE: All procedures assume that you have found all red fault LEDs and that they have been corrected before proceeding to the troubleshooting process.

The procedure is to reduce the Operator Interface (OI) to a configuration which you know works. From that point you can selectively add removed components until the faulty component is isolated.

CAUTION

Remove power from the card cage each time a card is removed or inserted. Do not touch the gold edge connectors on any board.

If at any point the installation of a circuit card stops the progress of booting, that card should be replaced. If this process does not find faulty components, contact FRSI for further assistance.

❑ **To diagnose a OI Card Cage problem:**

1. Remove all OI card cage circuit boards except the Power Regulator. Put them on a grounded static mat.

CAUTION

Use a grounded wrist strap with a built-in one megohm resistor for your safety and the protection of static sensitive circuits. The resistor allows static electricity to drain to ground and still isolates you from direct ground.

2. If the Power Regulator green LED comes on when power is applied, the Power Regulator is operational.
3. Install the the OI Processor. When power is applied the red LED will be on until the processor completes running the self-diagnostics. When the green LED comes on, the Processor has passed all the power up diagnostics and should be considered operational.
4. Install the Video Generator. Either the green or the red LED will be on until the processor starts to run the diagnostics on this board. While diagnostics are being run, the red LED will be on. When the diagnostics are completed successfully, the green LED is turned on by the processor. As soon as the Video Generator is installed, you should be able to see the progress of the diagnostic tests on the screen.

5. Monitor the Console Power-Up screen for error indications.
6. Install the PeerWay Interface. Either the green or the red LED will be on until the processor starts to run the diagnostics on this board. While diagnostics are being run, the red LED will be on. When the diagnostics are completed successfully, the green LED is turned on by the processor.
7. Install the Printer Interface. Either the green or the red LED will be on until the processor starts to run the diagnostics on this board. While diagnostics are being run, the red LED will be on. When the diagnostics are completed successfully, the green LED is turned on by the processor.
8. Install the SCSI Host Adapter. Either the green or the red LED will be on until the processor starts to run the diagnostics on this board. While diagnostics are being run, the red LED will be on. When the diagnostics are completed successfully, the green LED is turned on by the processor.

CAUTION

Before you put the console back into service, be sure to switch all of the OI card cages off. Switch them back on together to ensure that the proper cage becomes the SCSI Master.

Troubleshooting ControlFiles

All procedures assume that you have found all red fault LEDs and that they have been corrected before proceeding to the troubleshooting process.

The general procedure is to reduce the ControlFile to a configuration which you know works. From that point you can selectively add removed components until the faulty component is isolated.

CAUTION

Use a grounded wrist strap with a built-in one megohm resistor for your safety and the protection of static sensitive circuits. The resistor allows static electricity to drain to ground and still isolates you from direct ground.

Do not touch the gold edge connectors on any board.

Remove all ControlFile circuit boards except the Power Regulator, one Coordinator Processor, and the Nonvolatile Memory. If the green LED on the Power Regulator and the Coordinator Processor comes on when enabled, they should be considered operational. If the Coordinator Processor does not successfully boot, replace the Nonvolatile Memory, Coordinator Processor or the Power Regulator. The goal at this point is to have the ControlFile Coordinator Processor operating.

Next install the the PeerWay Buffers. At this point you should be able to see the ControlFile Status on the console.

Continue installing the other Power Regulator, Coordinator Processor, and the Controller Processors one at a time until the faulty component is found. If, at any point, the installation of a circuit card stops the progress of Booting, that card should be replaced.

CAUTION

When performing this procedure care must be taken to disable the Nonvolatile Memory and then the Coordinator Processors each time a card is removed or inserted (with the exception of the PeerWay Buffer cards).

Turn off the Nonvolatile Memory card before removing AC and DC power.

NOTE: Any slot which previously contained a PLC, RBLC, or MUX Controller must have either a WIPE BUBBLE or KILL CONTROLLER performed on it prior to loading an image or configuration. Failure to do so could cause some strange errors or problems with the controller.

If a nonredundant Coordinator Processor card is disabled on a running process, all operator process changes, links between controllers in that cage, and links to and from that ControlFile will freeze at the last value received. The controller will continue to operate the process under these conditions. As soon as the Coordinator Processor is restarted, all links will be updated.

If a Controller Processor card is disabled on a running process, the analog output Field interface card and the discrete output module will either hold their last value or go to zero, depending on the position of the jumper on the Field interface card. If it is necessary to close (go to zero) the output of the field device that uses the ”HOLD” mode after the controller is disabled, the Field Interface card must be removed.

If both PeerWay Buffer cards are removed from the ControlFile on a running process, all operator changes and links to and from this ControlFile will freeze at the last value received. The links within the ControlFile will continue to update. The Controller Processors will continue to operate under these conditions.

ControlFile Troubleshooting

Condition	Action
Controller Processor card will not pass Power Up Diagnostics. Green LED does not come on.	1. Replace the Controller Processor card.
Controller Processor card will not start. The green LED comes on briefly with all yellow LEDs on.	1. The yellow LEDs on the Coordinator Processor and Nonvolatile Memory cards must be flickering, indicating that the cards are operating properly. **NOTE:** if no Controller Processor card is running inside this ControlFile, the Nonvolatile Memory card will have only a green LED on. If the Coordinator Processor and Nonvolatile Memory card LEDs are not as indicated, see section on “Coordinator Processor will not load from Nonvolatile Memory“. 2. Perform a Wipe Bubble command on the suspect Controller Processor card. Re-enable the Controller Processor card after the Wipe Bubble procedure is performed. If the Controller Processor now starts, the plant Configuration must be reloaded from disk for that controller. Refer to the Wipe Bubble Procedure in this section. 3. Using a disk with the same software level as in the ControlFile, perform a Disk Load Program command on that ControlFile. It is normal to have an active hardware alarm “Program Image Bad” for this node during the Disk Load Program function. The alarm must clear after the Disk Load Program is complete. If the Disk Load Program is successful, try to restart the Controller Processor card. 4. If the Controller Processor card has been jumpered for additional images, check the jumper positions on the card. See Chapter 4 of this manual for jumper positions and locations. 5. Replace the Nonvolatile Memory card if the Disk Load Program is not successful. (Then attempt the Nonvolatile Memory Recovery Procedure.) 6. Replace the Controller Processor card. 7. Replace the Coordinator Processor card.

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ControlFile Troubleshooting (continued)

Condition	Action
Controller Processor card will not start with the Coordinator Processor card in one of the two Coordinator Processor card slots. If the Coordinator Processor card is installed in the other slot, the controller will run.	1. Replace the Controller Processor card. 2. Replace the Coordinator Processor card. 3. Check the terminators on the back of the ControlFile motherboard 4. Replace the terminators.
Controller Processor card will run alone, but will not run as a redundant pair. (Either controller alone will start and run.)	1. Check the Controller Processor cables on the back of the motherboard and verify that both the upper and lower cable connections for the two redundant Controller Processor slots are in place. 2. Ensure that both Controller Processors are seated properly inside the ControlFile. 3. Replace one Controller Processor at a time with a known good Controller Processor in redundant configuration.
Coordinator Processor will not pass Power Up Diagnostics. The green LED does not come on and the top yellow LED is off.	1. Replace the Coordinator Processor card.

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ControlFile Troubleshooting (continued)

Condition	Action
Coordinator Processor will not load from the Nonvolatile Memory card. The green LED comes on briefly, then the red FAULT LED comes on. The top yellow LED is on.	1. Insure that the Nonvolatile Memory card switch is in the ENABLE position. 2. Insure that the Nonvolatile Memory card is in the proper slot within the ControlFile. (See diagram on ControlFile door.) **NOTE:** If the primary Coordinator Processor is running and the secondary is not, the primary should NOT be disabled at this time. An attempt should be made to load the Plant Program into the nonvolatile memory (Disk Load Program function). If the function fails the Nonvolatile Memory card must be replaced. 3. Move the Coordinator Processor card to its redundant slot. If the Coordinator Processor works in the redundant slot, see the Troubleshooting section on “Coordinator Processor will not start in one of the two slots”. 4. Replace the Nonvolatile Memory card. **NOTE**: The Nonvolatile Memory Recovery Procedure may help recover the card if it is bad. The PeerWay Boot Procedure is also available. 5. Replace the Coordinator Processor card. 6. Insure ControlFile upper and lower terminators are installed correctly. **NOTE:** If no Controller Processors were running, the plant configuration must be reloaded from disk.

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ControlFile Troubleshooting (continued)

Condition	Action
Coordinator Processor starts but stops after a short period of time. ControlFile appears on the ControlFile Status screen and then disappears.	1. Pull out the two PeerWay Buffer cards in the ControlFile. 2. Reseat the Coordinator Processor and Nonvolatile Memory cards and try to restart the Coordinator Processor. 3. If the Coordinator Processor now starts and runs, check the Control Block Directory screens (a configuration key must be used when viewing the screens) of all other ControlFiles on the PeerWay for corrupted data. Look for scrambled loop tags and abnormal block status and dynamic memory sizes. 4. If a suspect controller is located, the Kill Controller function must be performed on all Controller Processors in that cage. After the Kill Controller has been performed, the plant configuration must be reloaded from the disk to the ControlFile. 5. With the PeerWay Buffers cards still removed, disable and remove all Controller Processor cards within the faulty cage. 6. Reseat the Coordinator Processor and Nonvolatile Memory cards and try to start just these two cards. If the Coordinator Processor will not stay running, replace it. 7. If the Coordinator Processor now starts and runs, begin installing the Controller Processor cards one at a time. As each card is installed, restart the Coordinator Processor and Controller Processor cards (this is done to determine if one of the Controller Processors is preventing the Coordinator Processor from running). 8. If a Controller Processor is found that prevents the Coordinator Processor from running, reseat and start the Coordinator Processor and Nonvolatile Memory cards with all Controller Processors set to DISABLE. After the Coordinator Processor is running, reinstall the PeerWay Buffer cards and perform the Wipe Bubble command for all Controller Processors in the ControlFile. 9. Turn all Controller Processors to ENABLE and allow them to restart. If one of the Controller Processors will not start, or if it will not allow the Coordinator Processor to start, replace that Controller Processor card. 10. After the ControlFile is running with all of its Controller Processors, load the Plant Configuration from disk for that ControlFile.

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ControlFile Troubleshooting (continued)

Condition	Action
Coordinator Processor card will not start in one of the two Coordinator Processor slots, but will start and run in the other slot.	1. Remove all cards in the ControlFile except for one Power Regulator card, one Nonvolatile Memory card, and one Coordinator Processor card in the faulty slot. Re-enable the Coordinator Processor and Nonvolatile Memory cards. If the Coordinator Processor now runs, proceed to step 5. 2. If the Coordinator Processor does not start, replace the Nonvolatile Memory card. 3. If the Coordinator Processor still does not start, replace the Power Regulator card. 4. If the Coordinator Processor still will not run in this slot, check the ControlFile terminators on the back of the ControlFile card cage. 5. Once the Coordinator Processor is running in this minimum configuration, install the remaining cards one at a time until the card is found that prevents the Coordinator Processor from running. Replace the faulty card.
Coordinator Processors will run separately, but not as a redundant pair.	1. Replace the Nonvolatile Memory card. 2. Replace the Coordinator Processor cards one at a time. 3. Check the ControlFile terminators on the back of the ControlFile card cage.

ControlFile Status Screen

The ControlFile Status screen is where you can find out what program type (such as $$CP, $$CPMax, or $$CPBat), and version level is loaded in the CP boards. The Coordinator Processor and Controller Processor must be booted to determine what $$CP program and version is loaded in the NV Memory .

You can find the Image type and the version level for each controller card on this screen by reading the “Card Type” Field, and the “Prgm Rev” fields for each Controller card. Also, you can tell what additional images are loaded in the NV Memory by the “Additional Images” fields, but you cannot tell what level of each Image is loaded in the NV Memory.

The Jumper Code field indicates MPC II or MPC5 functionality and image selection as determined by jumpers on the MPC II card. Displayed as X_Y_Z where:

X = MPC II HD2 setting: 0 for MPC I functionality
1 for MPC II functionality

Y = combination of HD6, HD7, and HD8 as an octal number

Z = combination of HD4, HD5, and HD9 as an octal number

See Section 4–2 for jumper details and CB: 3–4 for a complete description of this screen.

Wipe Bubble Procedure

The following procedure describes how to perform a Wipe Bubble procedure on the ControlFile Nonvolatile Memory. Wiping rewrites the header and purges the plant configuration information for the specified Controller Processor card. The command works on Bubble NV Memory and RAM NV Memory.

CAUTION

When a Wipe Bubble or a Kill Controller procedure is performed on an MPCI controller, all *ENTRY and *VALUE items will be lost. Write down the values BEFORE wiping the configuration.

When a Wipe Bubble or a Kill Controller procedure is performed on a MUX configuration the calibration constant of the FEMs will be lost. The calibration constants should be written on the FEM.

❑ **To wipe the NV memory:**

1. Toggle the desired Controller Processor card enable/disable switch to DISABLE.
2. Move the cursor to the command line and press:

   WB = [Controller Processor address]

   An alarm is generated:

   BUBBLE WIPED FOR CONTROLLER=xx

   The NV memory is now wiped.
3. Toggle the Controller Processor card enable/disable switch to ENABLE.

Troubleshooting I/O

This section covers I/O troubleshooting:

- General I/O problems
- Analog Card Cages
- FlexTerms
- Field Interface cards.
- RBL controller and cards.

These procedures assume that you have found all red fault LEDs and that they have been corrected before you proceed to the troubleshooting process.

CAUTION

Use a grounded wrist strap with a built-in one megohm resistor for your safety and the protection of static-sensitive circuits. All cards should be placed on a grounded static mat or be placed in a static protection envelope.

Potential problem areas include:

- Bad fuses (in and out – no indicators)
- Bad card
- Bad Controller card
- Bad cable
- Bad software
- Bad firmware
- Bad I/O Block or ControlBlock configuration
- Bad field device

CAUTION

Remove power from the Multiplexer FlexTerm before installing or removing any cards.

Restoring Redundant FICs

When a primary FIC with redundancy fails, the redundant FIC takes over. The failed FIC lights its red LED or flashes its green LED. Replace the failed FIC and determine that the new FIC has its green LED lighted and that the FIC Status screen shows no error for the FIC. The “Health” field of the primary FIC will still show “Bad”.

The original configuration must be restored to have redundancy effective again.

WARNING

Do not pull the redundant FIC to force a switch back to the primary FIC. This introduces a “double hardware failure” and may result in unexpected operation.

❑ **To restore FIC redundancy:**

1. Call up the RIOB screen.
2. Put the RIOB in MANUAL.
3. Highlight the line:

   Reset Backup of Line n (Press Enter)

   and press [ENTER].

   This restores the primary FIC and resets the backup FIC for backup action. The Health field of the primary FIC will now show “Good”.
4. Put the RIOB in AUTO.

   Normal redundancy operation is restored.

Serial (MPC) I/O Troubleshooting

Condition	Action
Analog Input No Reading Inst. Low Alarm AIB Field Reading - 25%	1. Use a VOM to check that the input current is in the range 4-20 mA. If a transfer card is installed, measure between test points on the card. Otherwise, measure at the marshaling panel by breaking the loop. If the current is OK: Check the FlexTerm to ControlFile cables. Replace the FIC. Replace the Controller Processor Card. If the current is not OK: Check all fuses on the FIC. 2. Using the RMT 262 Field calibrator (or similar device), input an appropriate current signal into the marshaling panel. If the value is wrong on the AIB screen, replace the FIC. If the value is correct on the AIB screen, check the field wiring and the transmitter. Be sure to check the system/self-powered jumper on the FIC.
Analog Input shows incorrect or unstable reading.	1. Using the RMT 262 Field Calibrator (or similar device), input an appropriate current signal into the marshaling panel. Check the Field Reading on the AIB screen. If the reading is incorrect: Calibrate the point. Replace the FIC. Replace the Controller Processor Card. If the reading is correct: Measure the transmitter current with the RMT 262 (or similar device). Check the field wiring for shorts and resistance to ground.

(continued on next page)

Serial (MPC) I/O Troubleshooting (continued)

Condition	Action
Analog output Feedback check alarm	1. Remove the field wiring from the marshaling panel for this FIC. Connect a Rosemount 262 Field Calibrator (or similar device) to the terminals. Put the AOB in MANUAL and enter an output value of 50.00%. Check the Actual Value reading on the AOB (it should be 50%) and verify that the Rosemount 262 meter reading is also 50% (12 mA). 2. If the Actual Value Reading and the meter reading are not 50%: Check all fuses on the output FIC. Calibrate the point. Replace the FIC. Replace the controller. 3. If the Actual Value and meter readings are 50% and the alarm clears off the Active Hardware Alarm List, the problem is an open circuit in the field wiring or the field device.

(continued on next page)

Serial (MPC) I/O Troubleshooting (continued)

Condition	Action
Discrete input module does not work. Input FIC point LED not on. FIC communications are OK.	1. Check the mode of the CIB; it must be in AUTO or MANUAL. If the Status Field is blank, this indicates an override condition, which is illegal for a CIB. Check if the discrete manual bypass is turned on for this point. Replace the FIC. Replace the FlexTerm motherboard. 2. Measure the voltage across the input terminations for the faulty point. **NOTE:** If the CIB is configured for Normally Closed (N.C.) operation, the Field State on the CIB screen will show ON when the module has no voltage across it and OFF when the module has voltage across it. 3. If no voltage is present across the point: Check the polarity for the DC module. Replace the module. Replace the FIC. 4. If all of the points on this FIC and the card next to it are not working, the FIC may not be seated properly in its connectors. It is possible one of the two connector tabs are not seated correctly in the FlexTerm motherboard connectors. **WARNING** **Before proceeding, remove all field voltage from the FIC to prevent shock or equipment damage.** Loosen the two captive screws holding the FIC in place. Gently move the card away from the FlexTerm mounting plate and verify that both card connector tabs are properly plugged into the motherboard connectors.

Multiplex I/O Troubleshooting

Condition	Action
Multiplex input point(s) bad.	1. Put an appropriate substitute signal into the point. Verify the accuracy to determine if the problem is system or field related. **CAUTION** **Always remove field DC power before working on a 4 – 20 mA input Front End Module (FEM).** **NOTE:** FEMs should not be removed or inserted with power on. If the problem is in the system: a. For thermocouples, check the configuration of the MIB. Verify that the "SIG CHAR" field is not configured for millivolts (example: J NBS is correct; do not use NBS mV). b. For 4–20 mA inputs with the 10 ohm dropping resistors mounted on the marshaling panel, remove the field wiring and measure the resistance of the resistor. c. Replace the FEM. 2. Remove the input signal from the FEM. Configure the MIB for "Raw Counts". The MIB input reading should be about 20000. If it is much lower, replace the FEM.
MIB I/O Block configuration shows FEM type "None Type C".	The FEM may have been inserted with MUX power ON. Turn MUX power OFF and then ON to force the MUX CPU to reinitialize.

RTD and Thermocouple I/O Troubleshooting

Condition	Action
RTD and thermocouple field problems.	For RTD and thermocouple field problems, the following items should be checked carefully: Loose or corroded connections or FEM not securely mounted in MUX. This can cause all input points to read as negative numbers. For FEM mounting instructions see SV: 5-3. Reverse polarity Wires shorted to case at temperature sensor Wrong type of thermocouple wire Noise caused by close proximity to AC wires High common node voltage. Measure from all device leads to chassis with a digital voltmeter using both AC and DC meter scales.
Universal Voltage FEM shows positive overload on open circuit.	This appears when Universal Voltage FEM is connected through a remote communication link and configured as a thermocouple input. The system cannot differentiate between a thermocouple with a high temperature reading and one with a broken or open loop. Check that the MUX CPU PROM is Doric (Beckman) part number 278-7000-03B.
Communication failure to MUX CPU and the Coordinator Processor.	Ensure that TransZorbs CR17 through CR20 are bipolar (PGKE47CA). The correct units have no polarity marking.
Low thermocouple reading (or reading at low value) for thermocouples attached to Universal FEM.	This appears when MIB is configured for TC or mv input. Replace the FEM.
Incorrect RTD readings with two or three-wire RTDs.	1. Check for correct wiring at FEM. See SV:5. 2. Check for correct wiring at RTD Marshaling Panel and at FEM. See SV: 5.

(continued on next page)

RTD and Thermocouple I/O Troubleshooting (continued)

Condition	Action
TC/RTD FIC shows poor accuracy.	If the sensor of an 1984-2731-000x TC/RTD FIC is disconnected and reconnected, the reading will be inaccurate for approximately ten minutes. The reading will be within 1% in one minute and will gradually gain accuracy. This is a characteristic of the circuit.
Discrete output module does not work. FIC communications are OK.	1. Put the COB into MANUAL Status and command the output to ON. Verify that the output LED for the FIC is on. The proper load must be connected. 2. If the LED is on: Check the module fuse Check the field voltage Replace the module If the LED is not on: Replace the module Replace the FIC **NOTE:** Output Modules ODC5A5 and OAC5A5 are Normally Closed Modules. 3. If all of the points on this FIC and the FIC next to it are not working, the FIC may not be seated properly in its connectors. It is possible one of the two connector tabs are not seated correctly in the FlexTerm motherboard connectors. **WARNING** **Before proceeding, remove all field voltage from the FlexTerm Termination card to prevent shock or equipment damage.** Loosen the two captive screws holding the FIC in place. Gently move the card away from the FlexTerm mounting plate and verify that both card connector tabs are plugged into the motherboard connectors properly.

Field I/O Status Screen (FIC Status Screen)

The Field I/O Status Screen (previously the FIC Status screen) displays information about the Field Interface Cards (FICs) and Field interface Modules (FIMs) that communicate with a Controller Processor. This screen is for display purposes only. No screen entries are allowed. To call up the Field I/O Status screen, type the command **FS** [=address] [ENTER] where "address" is the hardware address such as =87F.

NOTE: MultiLoop FlexTerms, some Contact FlexTerms, and Multiplexor FlexTerms cannot be displayed on this screen.

Field I/O Status Screen Fields

Field	Description of Displayed Information
Cont	Address of the Controller Processor in the ControlFile.
1 2 3 4 5 6 7 8	Communication line from the controller.
A, B, C, D	Card cage address letter.
Type	Configured type of FIC. When the type is changed, this is displayed in the corresponding alarm color. AO — Early analog output card AIO — Analog I/O (2 in 1 out or 3 in FIC with all programs in ROM) AIO_R — Redundant Analog I/O (2 in 1 out or 3 in FIC with redundancy and down-loadable code in battery backed RAM) AIO_RS — Redundant Analog I/O with Smart daughterboard (2 in 1 out or 3 in FIC with redundancy, downloadable code in battery backed RAM, and a Smart daughterboard for HART communication) CIO — Contact I/O (six points per card) DIO — Discrete I/O (32 point discrete input/output FIM) MAI — Multipoint Analog Input (16 point Input FIM) MAI32-x — Multipoint Analog 32 Point Input (32 point input FIM). "x" shows cage address of the "other" 16 points. MAO — Multipoint Analog Output (16 point output FIM) PIOB — Pulse input/output FIC SI — HART input card TIB — Temperature input FIC

(continued on next page)

Field I/O Status Screen Fields (continued)

Field	Description of Displayed Information
F-Rev	Revision level and firmware of the FIC.
S-Rev	Revision level of the FIC software.
Status	Displays the status of the FIC. Refer to the next table for a list and description of the status bits that may appear.

FIC/FIM Status Bits

Status for:	Status Bits	Bit	Description
Any	NON-BOOT		Indicates that the FIC/FIM program needs to be loaded.
Analog FIC Bits:	1xxx xxxx	7	Lost calibration: Set to 1 if any A/D or D/A calibration constants become questionable.
	x1xx xxxx	6	A/D converter failure. Set to 1 if any A/D converter does not complete a conversion within 45 milliseconds.
	xx1x xxxx	5	Smart Transmitter message available. Set to 1 when a message is available.
	xxx1 xxxx	4	Redundancy Jumper. Set to 1 for 1:1 redundancy. Set to 0 for other redundancy (including none).
	xxxx 1xxx	3	Output Bypass Unit status. Set to 1 when the Output Bypass Unit is active.
	xxxx x1xx	2	Hold/Zero jumper setting. Set to 1 to hold output value if a problem occurs.
	xxxx xx1x	1	Normal/Inverse acting valve jumper setting. Set to 1 for inverse acting valves.
	xxxx xxx1	0	Background diagnostics failure. Set to 1 if any background diagnostic test (except calibration constants) fails.
Analog FIM Bits:	1xxx xxxx	7	Indicates the health of the other FIM. Set to 1 if the other FIM is “sick” or missing.
	x1xx xxxx	6	Set to 1 if this FIM is disconnected from the field.
	xx1x xxxx	5	Indicates the health of this FIM. Set to 1 if this FIM is “sick”.
	xxx1 xxxx	4	Input Data Validity; Set to 0 if the data is good. Set to 1 if the data is invalid. Output Data Validity: This bit is not used for outputs.

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FIC/FIM Status Bits (continued)

Status for:	Status Bits	Bit	Description
Analog FIM Bits: (continued)	xxxx 1xxx	3	Not currently used. Always set to 0. (Early versions reported DC power status with this bit.)
	xxxx x1xx	2	Loop Power Module status bits: 0 for Loop Power Module A. 1 for Loop Power Module B.
	xxxx xx1x	1	Set to 0 when the Loop Power Module is good. Set to 1 when there is a problem with the Loop Power Module.
	xxxx xxx1	0	Set to 0 when the Loop Power Module is present. Set to 1 when the Loop Power Module is absent.
Contact Bits:	1xxx xxxx	7	Setting of the Hold jumper: 1 = Hold, 0 = Off
	x1xx xxxx	6	Diagnostics: 1 = Fault, 0 = OK
	xx1x xxxx	5	Point 6 when the OBU is connected: 1 = Normal, 0 = Override
	xxx1 xxxx	4	Point 5 when the OBU is connected
	xxxx 1xxx	3	Point 4 when the OBU is connected
	xxxx x1xx	2	Point 3 when the OBU is connected
	xxxx xx1x	1	Point 2 when the OBU is connected
	xxxx xxx1	0	Point 1 when the OBU is connected
Pulse Bits:	1xxx xxxx	7	RAM test result: Set to 1 if the RAM background test fails.
	x1xx xxxx	6	ROM test result: Set to 1 if the ROM checksum fails.
	xx1x xxxx	5	CPU test result: Set to 1 if the CPU test fails.

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FIC/FIM Status Bits (continued)

Status for:	Status Bits	Bit	Description
Pulse Bits: (continued)	xxx1 xxxx	4	Redundancy status: Set to 1 for 1:1 redundancy; set to 0 for any other redundancy (including none).
	xxxx 1xxx	3	Not used.
	xxxx x1xx	2	D/A failure: Set to 1 when the D/A has failed three times in a row.
	xxxx xx1x	1	Open loop: Set to 1 if analog output is open circuit.
	xxxx xxx1	0	General diagnostic status: Set to 1 if any diagnostic test fails.
Temp Bits:	1xxx xxxx	7	Lost calibration: Set to 1 if any A/D calibration constant becomes questionable.
	x1xx xxxx	6	A/D Converter failure.
	xx1x xxxx	5	Not used.
	xxx1 xxxx	4	Redundancy Jumper setting.
	xxxx 1xxx	3	Not used.
	xxxx x1xx	2	Not used.
	xxxx xx1x	1	Not used.
	xxxx xxx1	0	General diagnostic status: Set to 1 if any background diagnostic test fails.

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FIC/FIM Status Bits (continued)

Status for:	Status Bits	Bit	Description
Discrete I/O FIM Bits:	1xxx xxxx	7	Health of the other FIM: Set to 1 when the other FIM is bad or is not present.
	x1xx xxxx	6	Disconnect bit: Set to 1 when the other FIM has been disconnected by this FIM.
	xx1x xxxx	5	Configuration bit: Set to 1 when there is a problem with the configuration of this FIM.
	xxx1 xxxx	4	A/D #4: Set to 1 when there is a problem with A/D group 4 (points 25–32).
	xxxx 1xxx	3	A/D #3: Set to 1 when there is a problem with A/D group 4 (points 17–24).
	xxxx x1xx	2	A/D #2: Set to 1 when there is a problem with A/D group 4 (points 9–16).
	xxxx xx1x	1	A/D #1: Set to 1 when there is a problem with A/D group 4 (points 1–8).
	xxxx xxx1	0	Overall test: Set to 1 if any test fails.

FIC Detail Screen

The FIC Detail screen displays information about the blocks that are associated with an individual FIC or FIM. This screen is for display purposes only. To call up the FIC Detail screen, cursor to the desired FIC or FIM and press [SELECT] from the FIC Status screen. To view the FIC Detail screen for a FIC or FIM, cursor to the desired card and press [SELECT]. If any I/O Block is in alarm the associated FIC or FIM will be in a corresponding color. There are five groups of status bits. The first is the same as for the FIC Status screen. The next four are for points 1–4, 5–8, 9–12, and 13–16.

FIC Detail Screen Fields

Field	Description of Displayed Information
Controller	Address of the Controller Processor associated with the particular FICs. None is displayed if no Controller Processor has been assigned.
Type	Configured type of FIC: analog I/O (AIO), contact I/O (CIO), redundant analog I/O (AIO-R), redundant AIO with Smart daughter board (AIO-RS), discrete I/O (DIO).
FIC	Slot number of the FIC within the Controller Processor.
F-Rev	Revision level and firmware of the FIC.
S-Rev	Revision level of the FIC software.
Status	Displays the status of the FIC.
Tag/Address	Tag or address of the FICs residing in the Controller Processor.
Type	Type of block on the FIC.
Value	Output value of the block.
Mode	Mode of the FIC: AUTO, MANUAL, or SIMULATE.

FIC/FIM Status Bits

Status for:	Status Bits	Bit	Description
Multipoint Discrete I/O FIM (MDIO)	1xxx xxxx	7	Not used.
	x1xx xxxx	6	Not used.
	xx1x xxxx	5	Input Latch for points 25–32: Set to 1 if bad.
	xxx1 xxxx	4	Input Latch for points 17–24: Set to 1 if bad.
	xxxx 1xxx	3	Input Latch for points 9–16: Set to 1 if bad.
	xxxx x1xx	2	Input Latch for points 1–8: Set to 1 if bad.
	xxxx xx1x	1	Output Latch for points 9–16: Set to 1 if bad.
	xxxx xxx1	0	Output Latch for points 1–8: Set to 1 if bad.
Multipoint Analog Input FIM (MAI)	1xxx xxxx	7	Overall health of point 4, 8, 12, or 16
	x1xx xxxx	6	Calibration Constant condition of point 4, 8, 12, or 16
	xx1x xxxx	5	Overall health of point 3, 7, 11, or 15
	xxx1 xxxx	4	Calibration Constant condition for point 3, 7, 11, or 15
	xxxx 1xxx	3	Overall health of point 2, 6, 10, or 14
	xxxx x1xx	2	Calibration Constant condition for point 2, 6, 10, or 14
	xxxx xx1x	1	Overall health of point 1, 5, 9, or 13
	xxxx xxx1	0	Calibration Constant condition for point 1, 5, 9, or 13
Multipoint Analog	1xxx xxxx	7	Feedback check for point 4, 8, 12, or 16
	x1xx xxxx	6	Calibration Constant condition for point 4, 8, 12, or 16
	xx1x xxxx	5	Feedback check of the point for point 3, 7, 11, or 15

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FIC/FIM Status Bits (continued)

Status for:	Status Bits	Bit	Description
Output FIM (MAO)	xxx1 xxxx	4	Calibration Constant condition for point 3, 7, 11, or 15
	xxxx 1xxx	3	Feedback check for point 2, 6, 10, or 14
	xxxx x1xx	2	Calibration Constant condition for point 2, 6, 10, or 14
	xxxx xx1x	1	Feedback check for point 1, 5, 9, or 13
	xxxx xxx1	0	Calibration Constant condition for point 1, 5, 9, or 13

Section 2:
Maintenance

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Scheduled Maintenance

Scheduled Maintenance

Procedures	Item	Frequency
Cleaning Tape Drives	Magnetic Tape Drives	Weekly
Cleaning Console Fan Filters	MiniConsole Cage Fan Filters MiniConsole Disk Drive Filters Basic Command Console Filters Command Console Cage Filters	Weekly
Cleaning Cabinet Filters	Cabinet Door Filters ControlFile Fan Filters Cabinet Fan Screens	Weekly
Checking LEDs	Disk Drives Consoles and ControlFiles Power Supplies	Weekly
Checking Active Hardware Alarms	Hardware Alarm List	Weekly
Maintaining the Printer	Change Ribbon	As required
Checking the AC/DC Power Supply Battery	Battery	6 Months
Replacing the AC/DC Power Supply Battery	AC/DC Power Supplies	Approximately every four years
Replacing the Power Supply Module Cooling Fan	System Power Supply Unit	3.5 Years
Maintaining the CRT	Glare Filter on MiniConsole CRT CC and BCC CRT, Clean and Degauss	6 Months
Running Off-Line Console Diagnostic Programs	Off-Line Background Diagnostic Checks **NOTE:** This should be done only by authorized FRSI personnel.	6 Months
Checking Calibration	Analog Input Blocks (AIB) Analog Output Blocks (AOB) Multiplexer Input Blocks (MIB)	6 Months 6 Months 6 Months

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Scheduled Maintenance (continued)

Procedures	Item	Frequency
Checking Voltages	ControlFile Power Regulator Console Power Regulator	6 Months 6 Months
Checking Backup Cards in Redundant Pairs	Coordinator Processor Controllers	6 Months 6 Months
Cleaning Cards	Consoles, Printer, ControlFiles & FlexTerms	12 Months / as required

WARNING

The AC/DC Power Supply weighs 70 pounds (32 kg). At least two persons should remove the supply from the cabinet to prevent injury.

WARNING

Prevent the CRT from sliding off the table, hold the CRT pan so that it does not tilt while you are removing the CRT screws.

WARNING

The fan blades are exposed during the console fan filter cleaning procedure. To avoid injury, keep fingers away from the fan.

WARNING

To prevent injury or damage to components, all field power to the FlexTerm must be removed before attempting to remove a Contact FlexTerm.

WARNING

To prevent accidental injury, make certain you have turned off the correct circuit breaker for the AC/DC Power Supply. The amber light on the front of the power supply should be off.

WARNING

When removing the Command Console Hard Disk Drive, disconnect the AC plugs in the support column to prevent shock when disconnecting the AC power cables on the supply.

WARNING

The Serial I/O Analog Output Points calibration procedures require that the process measurement or output drive be completely disconnected from the control system. Any control scheme using a measurement to be calibrated must be in MANUAL mode. Any devices connected to an output to be calibrated must be isolated from the process.

Filter Replacements

Filter Replacements

Application	Filter	Part Name
MiniConsole Card Cage	G12918-0001	Fan Filter Replacement
MiniConsole Floppy Disk Drive	G12918-0002	Fan Filter Replacement
Multitube EC Cabinet	1984-0359-0006	Fan Filter Replacement
Command Console	G12918-0002	Fan Filter Replacement
Cabinet Door, Series I	1984-0359-0003	Filter Replacement, Door
Cabinet Door, Series 2	1984-0359-0008	Cabinet Filter
ControlFile	1984-0359-0001	Fan Filter Replacement
OI Card Cage HIA SCI SRU	1984-0359-0002	Filter Replacement - HIA, SCI, SRU
Tower Electronics Cabinet	1984-0359-0007	Filter Replacement - Tower Door
7U Hanging Cabinet	10P55500011	Filter Replacement - Bottom of Cabinet

WARNING

The fan blades are exposed during the filter cleaning procedure. To avoid injury, keep fingers away from the fan.

Cleaning Tape Drives

Magnetic tape drives should be cleaned once a week or after every eight hours of tape operation. Clean the drive after 2 hours of operation with new tape cartridges.

Use a 1984-2154-0001 Tape Drive Head Cleaner Kit. Additional supplies are available in the 1984-2154-0002 Tape Drive Head Cleaner Refill Kit.

Follow the directions supplied with the kit.

Cleaning Floppy Disk Drives

Disk drives should be cleaned periodically or when excessive errors occur.

Use a 1984-2891-0001 Floppy Drive Cleaner Kit for the 3.5-inch drives and a 1984-2891-0002 Floppy Drive Cleaner Kit for the 5.25-inch drives.

Cleaning the Trackball

Most problems with a trackball can be cured by a thorough cleaning. Dirt accumulates around the ball itself and in the optical disk readouts inside the assembly. The trackball itself can be replaced without replacing the entire assembly.

❑ **To clean a trackball:**

Required tools:

#1 Phillips screwdriver
1/16-inch Allen wrench
Source of dry air under pressure (20 psi max)
Denatured alcohol

1. The Trackball Assembly can be part of the Operator Keyboard Assembly or be free standing.
   a. Operator Keyboard Assembly: Unplug the keyboard cable from the keyboard interface card. Turn the keyboard assembly over and remove the four screws that hold the Trackball Assembly to the Operator Keyboard.
   b. Free-standing trackball: Unplug the trackball cable. Remove the four screws that hold the base in place.
2. Remove the two brackets that hold the black box containing the trackball. Push the black box out. This may require some force since the black box is glued to the assembly.
3. Unplug the black box from the trackball electronics.
4. Remove the black box top cover (four Allen screws).
5. Remove and clean the ball and the area around the hole in the cover.
6. Use dry air to blow dust and dirt out of the optical sensor wheels and sensors.
7. Clean the bearing that holds the ball tightly against the sensor wheels.
8. Reassemble the black box.
9. Connect the trackball electronics cable and install the box in the trackball assembly, being careful to center the ball in the hole in the keyboard before you tighten the brackets.
10. Replace the base or reinstall in the keyboard assembly.
11. Plug in the cable and test. If the trackball does not work, replace the black box (1984–1653–000x).

Removing and Installing Cards

Proper procedures must always be followed when removing or inserting cards in the system. Observe the following precautions and instructions when working on the system.

- Use a grounded wrist strap with a built-in one megohm resistor for your safety and to prevent damage to static sensitive circuits. The resistor allows static electricity to drain to ground while isolating you from direct ground.
- Before removing AC and DC power from the system, move all Nonvolatile Memory card ENABLE/DISABLE switches to the DISABLE position.
- Before removing or inserting any card (except a PeerWay buffer card) in a ControlFile, first disable the Nonvolatile Memory card and then the Coordinator processor card by placing the ENABLE/DISABLE switches to the DISABLE position.
- Always power down consoles before removing or installing cards.

  NOTE: The Disk shutdown (DS) command should always be performed before powering down the console. This will purge the cache and prevent possible loss of data.
- Check the jumper positions when you replace a card.
- Ensure that cards are seated properly.
  - Place your right thumb on the upper plastic card extractor lever and place your left thumb on the lower extractor.
  - Push evenly and firmly with both thumbs at the same time. You should feel the card seat.
- All circuit cards must be in antistatic bags when outside their card cage. Use approved antistatic bags when shipping or storing cards.
- Never handle circuit cards by the edge connectors. Small amounts of oil from your skin can contaminate the edge connectors, causing problems with intermittent contacts.
- Use only approved nonstatic brushes to clean edge connectors. Never use erasers, abrasive materials, or nylon brushes. Abrasives can remove the gold flash, and other materials can cause static electricity damage to onboard components. Follow the instructions in “Cleaning Cards” in this section.

Cleaning Cards

Cards should be removed from the system and cleaned once a year (more often in installations where conductive dust is present). The cards must be removed and cleaned in an antistatic work area, using an antistatic mat on the work surface and an antistatic wrist strap. Clean cards with an air hose or vacuum cleaner that is static protected.

❑ **To remove dust from cards:**

1. Use an air hose to blow the dust off the cards and assemblies. Use very dry air or an ionizing nozzle on the air hose to prevent static damage to the cards. Air pressure should be limited to 2.1 Kg/cm^2 (30 PSI).

or

2. Use a vacuum cleaner. We recommend use of a dust attachment with a wire wrapped around the brush bristles, connecting to ground through a 1 megohm resistor to eliminate static buildup on the brush.

❑ **To clean edge connectors:**

CAUTION

Do not use a rubber eraser to clean edge connectors. A rubber eraser wears away the thin gold coating on the connector and will then allow the contacts to corrode.

1. Use a “RUSH BRUSH” or similarly designed edge connector brush to remove oxidation and contaminants from the gold coated edge connectors.
2. To remove contaminants, wipe connector contacts with a soft tissue wetted with denatured alcohol.

Storing Cards

Cards must be stored in a clean area, free of corrosives. Always store cards in an approved antistatic bag.

Section 3:
Power

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DC Power Distribution System Color Codes

Standard Color Codes for Wiring and Test Points

Color	Voltage
Orange	+30 VDC
Brown	Ground Return
Red	+12 VDC
Blue	-12 VDC
Yellow	+5 VDC
Purple	+9 VDC (Unregulated) (1)
White	+5 V Relative Current Indication
Green	+12 V Relative Current Indication
Gray	Isolated Ground Return

(1) Violet is used for test points on the -2494 Analog Transfer Card.

AC Entrance Panel 10P5662000x
..... 1984-0303-000x

AC Input Wiring

Terminal	115 VAC Wiring	230 VAC Wiring
L1	Hot	Line 1
L2/N	Neutral	Line 2
⏚	Ground	Ground

Dual Feed AC Entrance Panel Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 F2	G09140-0017	MDQ 1/2	313.500	.5 A 250 V Slow Blow

WARNING

For personal safety, it is wise to use a circuit breaker lockout device to ensure that an opened breaker is not accidentally closed while you are working on the line.

WARNING

Dangerous AC voltage may be present even if the "AC IN" indicator is not lit. If the input fuse is blown, AC may still be present at the input terminal block.

System Power Supply Unit
Module 12P0238X012
Housing 12P0236X012
Fan Replacement Kit 12P0239X012

System Power Supply Module Parts Replacement

Part No.	Replaces	Comment
12P0238X012	- -	The 12P0238X012 supply module is NRTL/C certified and CE-compliant. Each power supply unit consists of at least one power supply module and one power supply housing. They cannot be mixed with 10P5658-XXXX, 1984-2298-XXXX, 10P5664-XXXX, or 1984-0390-XXXX AC/DC power supplies on the same DC bus.

AC/DC Power Supply
(With Battery Backup) 10P5658000x
..... 1984-2298-000x
..... 1984-0298-000x
OI Remote Power Supply 1984-1046-000x

AC/DC Power Supply (With Battery Backup) Parts Replacement

Part No.	Replaces	Comment
10P5658000x	1984-0298-000x 1984-2298-000x	The 10P5658000x supply is CE-compliant
1984-2298-000x	1984-0298-000x	Supplies are fully interchangeable
1984-0298-000x	1984-2298-000x	Supplies are fully interchangeable
1984-2298-000x or 1984-0298-000x	1984-0390-000x	Either supply may replace a -0390 AC/DC Power Supply (Without Battery Backup) but the BATT switch must be turned OFF. **NOTE:** The PS FAULT alarm jumper (HD1) must be set to 2-3 since the -0390 contacts are Normally Closed (N.C.).

Power Supply (With Battery Backup) Indicators and Controls

Item	Function
BATT ON/OF Toggle Switch	Removes the battery backup circuit from the system when in OFF position.
BATT TEST Pushbutton	The Battery Test Pushbutton is used to manually enable the 16 amp, 5 second battery test. If battery voltage falls below 20 V during the test, the BATT FAULT LED lights and the battery alarm activates. **NOTE:** The battery cannot be tested until the system has been running for at least five minutes or until five minutes after the last battery test.
AC IN Indicator (Orange)	Indicates that AC input is present.

(continued on next page)

Power Supply (With Battery Backup) Indicators and Controls (continued)

Item	Function
OUTPUT CURRENT (Bar Graph LED) (Red)	This is a series of LEDs indicating the relative current being delivered to the DC distribution system by the AC/DC power supply. It indicates the load share provided by the power supply with a readout in 3 amp intervals. Power supplies should be within 1 to 2 LEDs of the others on the DC distribution system for proper load sharing.
PS FAULT LED (DS1) (Red)	The 30 Volt DC output has dropped below 26 Volts. The power supply alarm is actuated when this LED is on.
PS NORM LED (DS2) (Green)	The DC output voltage and battery status (if the battery is used with the header jumper enabled) is in normal working condition.
BATT FAULT LED (DS3) (Red)	The battery has failed the periodic load test. Approximately once every 24 hours the unit automatically tests the batteries under a 16 amp load for five seconds. If battery voltage drops below 20 Volts DC (24 Volts nominal), the BATT FAULT LED will light, the PS NORM LED will go out, and the battery fault alarm will activate. The battery fault alarm will also activate if the battery test fails.

AC/DC Power Supply (With Battery Backup) Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G50527-0004	--	SLC50	50 A 300 V Time Delay
F2	50P03980007	SC-30	--	30 A 300 V Time Delay

Battery Charger Card 1984-1283-000x

Battery Charger Card Test Points

Test Point	Function	Comment
TP1	Return reference	
TP2	Reference voltage 2.35 Volts	Adjust with variable resistor R1
TP3	Battery voltage 27.6 Volts	Adjust with variable resistor R2

Battery Charger Card Jumper Positions

Jumper	Purpose	Position
HD1	Alarm contact for power supply fault	1-2 N.O. - Contact is normally open 2-3 N.C. - Contact is normally closed
HD2	Alarm contact for battery fault	1-2 N.O. - Contact is normally open 2-3 N.C. - Contact is normally closed
HD3	Battery connection	1-2 W BAT - Test Battery every 24 hours 2-3 W/O BATT - Do not test Battery

Battery Charger Card Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0016	AGC 1/2	312.500	.5 A V 250 Quick Acting
F2	G09140-0030	AGC 2	312002	2 A 250 V Quick Acting

AC/DC Power Supply (Without Battery Backup) 10P5664000x
..... 1984-0390-000x

AC/DC Power Supply (Without Battery Backup) Parts Replacement

Part No.	Replaces	Comment
10P5664000x	10P5658000x	Power Supplies are interchangeable only in systems that do not use batteries. The BATT switch on the replaced unit must have been turned OFF. The PS FAULT contact (if used) must have been jumpered as Normally Closed (N.C.).
1980-0390-000x	1984-0298-000x or 1984-2298-000x	Power Supplies are interchangeable only in systems where the batteries are not being used. The BATT switch on the replaced unit must have been turned OFF. The PS FAULT contact (if used) must have been jumpered as Normally Closed (N.C.).

AC/DC Power Supply (Without Battery Backup) Indicators

Item	Function
AC IN (Orange)	Indicates that AC input is present.
POWER (Green)	Indicates that the DC output voltage is in normal working range. The power supply alarm is actuated when this LED is off.

AC/DC Power Supply (Without Battery Backup) Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	50P03980007	SC-30	--	30 A 300 V Time Delay

MTCC Remote Power Supply 10P5645000x
..... 1984-3023-000x

MTCC 1984-3023-000x Remote Power Supply Jumper

Jumper	Position
Internal Wire	In place (-0001 110 V input)
	Removed (-0002 220 V input)

MTCC Remote Power Supply Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 power supply: 1984-3023-000x	G09140-0064	GMC-5	--	5 A 250 V Miniature
F1 power supply: 10P5645000x	G09140-0041	MTH5	312005	5 A 250 V 1-1/4 in.

DC/DC Power Supply 1984-0393-000x

DC/DC Power Supply Specifications

Parameter	Specification
Power supply type	Switching regulator
Temperature range	0° C to 50° C
Input voltage	30 Volts DC
Input voltage range	10 Volts DC to 60 Volts DC
Line regulation	± .5% with input voltage >15 Volts
Output voltage	1984-0393-0001: set @ 24 Volts DC 1984-0393-0002: set @ 24 Volts DC 1984-0393-0003: set @ 15 Volts DC
Output voltage range	4.4 Volts DC to 30 Volts DC
Output current	0 to 12 Amps
Output ripple	50 milliVolts (0-25K Hz) 150 milliVolts (total)

DC/DC Power Supply Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
All	G09140-0036	MDL 3	313003	3 A 250 V Slow Blow

AC/DC Unregulated Power Supply 1984-1089-000x

AC/DC Power Supply Specifications

Parameter	Specification
Voltage	1984-1089-0001: 115 Volts AC 1984-1089-0002: 220 Volts AC
Input Voltage Range	1984-1089-0001: 104 to 127 Volts AC 1984-1089-0002: 198 to 242 Volts AC
Frequency Range	47 to 63 Hz
Output Source	Nominal: 27.5 Volts, 7.5 Amps

AC/DC Unregulated Power Supply Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0046	AGC 10	311010	10 A 32 V Regular

Remote I/O Power Supply . . . . . 10P57010001 . . . . . 1984-4302-000x

The Remote I/O Power Supply is used with an AC Distribution Block and a DC Distribution Block and their internal fuses.

Remote I/O Power Supply Specifications

Power Supply	Voltage
10P57010001	110 Volts AC to 230 Volts AC Autosensing
1984-4302-0001:	110 Volts AC
1984-4302-0002:	220 Volts AC

Remote Power OI Supply 10P57560001

Remote 10P5756 OI Power Supply Specifications

Power Supply	Voltage
10P57560001	110 Volts AC to 230 Volts AC Autosensing

Remote Power Supply .....
For Operator Interface (OI) Applications 10P5409000x
For Input/Output (I/O) Applications 10P5503000x

The supplies differ only in mounting bracket and cables. The 10P5503 unit is used in conjunction with the AC Distribution Block and DC Distribution Block.

Remote Power Supply Specifications

Parameter	Specification
Voltage	-0001 & 3: 115 Volts AC -0002 & 4: 230 Volts AC
Output	24 VDC, adjustable ±1 Volt 6 Amp

Remote Power Supply Fuses

FRSI P/N	Wickman P/N	Schurter P/N	Characteristics
--	19372K	Series MST 250	3.15 A, 250 V Slow Blow, Plug-In

Connector Pin-Out

Pin	Description
6	DC + output
14	DC return
16	Jumper to pin 32 (connects DC return to AC safety ground)
28	L1 AC line 1
30	L2/N AC line 2 (230 V) or neutral (115 V)
32	AC safety ground

AC Distribution Block 1984-4329-0001
DC Distribution Block 1984-4329-0002
. 1984-4329-0003

The AC Distribution Block and DC Distribution Block are used with the Remote Power Supply and the Remote I/O Power Supply. Each distribution block has internal fuses. Input power must be connected to the side of the block holding the jumper.

Distribution Block Fuses

Block	FRSI P/N	Wickman P/N	Littelfuse P/N	Characteristics
AC Distribution	G53394-3000-1	Series 19197	Series 235	3.0 amp 250 V CSA approved
DC Distribution 10 Circuits	G53394-1000-1	Series 19197	Series 235	1.0 amp 250 V CSA approved
DC Distribution 1 Circuit	G53394-3000-1	Series 19197	Series 235	3.0 amp 250 V CSA approved

DC Output Card 1984-1264-000x

DC Output Card Fuses

Device	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
Multitube Command Console: 1 Tube	G09140-0047	AGC 15	311015	15 A 32 V Regular
Multitube Command Console: 2 Tubes	G09140-0061	ABC 20	314020	20 A 250 V Regular
Multitube Command Console: 3 Tubes	G09140-0061	ABC 20	314020	20 A250 V Regular
Command Console	G09140-0047	AGC 15	311015	15 A 32 V Regular
MiniConsole	G09140-0047	AGC 15	311015	15 A 32 V Regular
ControlFile	G09140-0061	ABC 20	314020	20 A250 V Regular
ControlFile Fan	G09140-0046	AGC 10	311010	10 A 32 V Regular
I/O Card Cage	G09140-0047	AGC 15	311015	15 A 32 V Regular
FlexTerm	G09140-0046	AGC 10	311010	10 A 32 V Regular
System Resource Unit (SRU)	G09140-0047	AGC 15	311015	15 A 32 V Regular
Highway Interface Adapter (HIA)	G09140-0047	AGC 15	311015	15 A 32 V Regular
Supervisory Computer Interface (SCI)	G09140-0047	AGC 15	311015	15 A 32 V Regular
System Manager Station (SCI)	G09140-0047	AGC 15	311015	15 A 32 V Regular
RS3 Network Interface (RNI)	G09140-0046	AGC 10	311010	10 A 32 V Regular

(continued on next page)

DC Output Card Fuses (continued)

Device	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
Multipoint I/O Term Panels	G09140-0046	AGC 10	311010	10 A 32 V Regular
Fiber Optic I/O Converter	G09140-0046	AGC 10	311010	10 A 32 V Regular

Section 4:
PeerWay

Twinax PeerWay Tap Block Set
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Tap Box B (CE Approved) 4-2

Optical Tap Box A
Optical Tap Box B 4-4

Electrical Tap Box A
Electrical Tap Box B 4-5

PeerWay Extender (PX)
PeerWay A
PeerWay B 4-6

Optical Repeater/Attenuator 4-8

Twinax PeerWay Tap Block Set 1984-0496-000x
Tap Box A (CE Approved) 10P52760001
. . . . . 1984-0488-000x
Tap Box B (CE Approved) 10P52790001
. . . . . 1984-0489-000x

NOTE: One tap box must be grounded on each PeerWay. Ground both PeerWay A and B at the same tap box.

PeerWay Tap Box Parts Replacement

Part	Part No.	Replaces	Comment
Tap A	10P52760001	1984-0488-000x	All installations.
	1984-0488-000x	10P52760001	Non-EMC installations only.
Tap B	10P52790001	1984-0489-000x	All installations.
	1984-0489-000x	10P52790001	Non-EMC installations only.

PeerWay Tap Box Test Points

Test Point	Range	Comment
TP1, 2 Yellow - Brown	4.75-5.25 VDC	Power for tap 1
TP3, 4 Yellow - Brown	4.75-5.25 VDC	Power for tap 2
TP5, 6 Yellow - Brown	4.75-5.25 VDC	Power for tap 3
TP7, 8 Yellow - Brown	4.75-5.25 VDC	Power for tap 4

10P5276 and 10P5279 Tap Box Grounding

Grounding Screw Position	Function
GROUND	Grounds the PeerWay Shield
OPEN	Normal setting

1984-0488 and -0489 Tap Box Grounding

Jumper	Position	Comment
HD3	GND	Grounds the PeerWay Shield
	HOLD	Normal setting

Optical Tap Box A 1984-3211-0001
. 1984-1191-0001
Optical Tap Box B 1984-3214-0001
. 1984-1192-0001

WARNING

Use care when handling optical cables. The ends are subject to damage from chipping, dust, and dirt. The cable may be damaged if it is bent at too small a radius.

Optical Tap Box Replacement Data

Part No.	Replaces	Comment
1984-3211-0001	1984-1191-0001	PeerWay A Optical Tap Box
1984-1191-0001	1984-3211-0001	PeerWay A Optical Tap Box
1984-3214-0001	1984-1192-0001	PeerWay B Optical Tap Box
1984-1192-0001	1984-3214-0001	PeerWay B Optical Tap Box

NOTE: One tap box, either optical or electrical, must be grounded in each set. Ground both PeerWay A and B at the same tap box.

Optical Tap Box Jumpers

Jumper	Position	Comment
HD3	GND	Grounds the tap box
	HOLD	Normal setting

Electrical Tap Box A 1984-3211-0002
..... 1984-1193-0002
Electrical Tap Box B 1984-3214-0002
..... 1984-1194-0002

NOTE: Electrical Tap Boxes are used only with Optical Tap boxes.

Electrical Tab Box Replacement Data

Part No.	Replaces	Comment
1984-3211-0002	1984-1193-0001	PeerWay A Electrical Tap Box
1984-1193-0002	1984-3211-0002	PeerWay A Electrical Tap Box
1984-3214-0002	1984-1194-0001	PeerWay B Electrical Tap Box
1984-1194-0002	1984-3214-0002	PeerWay B Electrical Tap Box

NOTE: One tap box, either optical or electrical, must be grounded in each group of optical and electrical tap boxes. Ground both PeerWay A and B at the same tap box.

Electrical Tap Box Jumpers

Jumper	Position	Comment
HD3	GND	Grounds the tap box
	HOLD	Normal setting

PeerWay Extender (PX) .....
PeerWay A 10P50930001
PeerWay B 10P50960001

CAUTION

The PX must be supplied with a reliable source of DC power. If the PX loses power, the PeerWay is broken at that point.

PX Parts Replacement Data

Part No.	Replaces	Name	Comment
Tap A 10P50930001	10P52760001	Twinax Tap Box A	Provides only two PeerWay drops.
	1984-0488-0001	Twinax Tap Box A	Provides only two PeerWay drops.
	1984-3211-0001	Optical Tap Box A	Provides only two PeerWay drops. Cannot connect to Electrical Tap Boxes.
	1984-1191-0001	Optical Tap Box A	Provides only two PeerWay drops. Cannot connect to Electrical Tap Boxes.
Tap B 10P50960002	10P52760002	Twinax Tap Box B	Provides only two PeerWay drops.
	1984-0488-0002	Twinax Tap Box B	Provides only two PeerWay drops.
	1984-3211-0002	Optical Tap Box B	Provides only two PeerWay drops. Cannot connect to Electrical Tap Boxes.
	1984-1191-0002	Optical Tap Box B	Provides only two PeerWay drops. Cannot connect to Electrical Tap Boxes.

PX LEDs

LED	Meaning
STATUS (Yellow)	The PX is running and has adequate power applied.
XMT (Yellow)	Fiber Optic Transmit – ON when messages are being transmitted on the fiber optic channel. ON continuously indicates a stuck transmitter.
RECV (Yellow)	Fiber Optic Receive – ON when messages are being received on the fiber optic channel. ON continuously indicates a stuck transmitter at the other end of the fiber.

Fiber Optic Power Switch

S3 Position	Effect
HIGH POWER	Full optical transmitter power is used
LOW POWER	Optical transmitter power is reduced 7 – 10 dB

Normal/Test Switch

S1 Position	S2 Position	Effect
Right	Right	Normal Mode
Right	Left	Disabled
Left	Right	Disabled
Left	Left	Test Mode

PX Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1, F2	G50382-0009	273.125	MSF 034.4210	1/8 A 125 V Plug-In
F3	G50382-0019	273.001	MSF 034.4221	1 A 125 V Plug-In

Optical Repeater/Attenuator 1984-0514-000x

LEDs for Optical Repeater/Attenuator

LED	Meaning
DS1	Hardware Good
DS2	Hardware Bad
DS3	+30V Fuse Blown
DS4	FO TX1 Failed
DS5	FO TX2 Failed
DS6	Data 1
DS7	Data 2

Optical Repeater/Attenuator Jumper Settings

Jumper	Normal Position	Test Position
HD1	1-2	2-3
HD2	1-2	2-3

Section 5:
Consoles

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Keyboard Alarm

Hardware alarm 090 warns of bad keys:

Board: Key <p:kkk> is bad

Where “p” is the keyboard number and “kkk” is the key number.

Multitube Command Console Keyboard Numbers

Keyboard Number	Keyboard
1	Configuration Keyboard (Alphanumeric Keyboard)
2	Trackball Keyboard
3	Operator Keyboard
4	Callup Option Keyboard 1 (Left)
5	Callup Option Keyboard 2 (Middle)
6	Callup Option Keyboard 3 (Right)

Enhanced Engineering Keyboard 1984-2386-000x
Main Keyboard/Trackball 1984-1634-000x
Main Keyboard/Trackball/Option 1984-2372-000x

Main Keyboard Parts Replacement

Part	Part No.	Replaces	Characteristics
Keyboard Electronics 68HC05	1984-2871-000x	1984-1970-000x	EMC compliant. Can replace any other board
Keyboard Electronics	1984-1970-000x	1984-2871-000x	Fully interchangeable except Not EMC Compliant.
Main Keyboard Replacement Subassembly	1984-1695-000x	Keyboard top	Without base or cable

Keyboard Electronics Board Jumper Positions for Use in Main Keyboard

Board use	HD1 (J1)	HD2 (J2)	HD3 (J3)	HD4 (J4)
Main Keyboard	1-2	1-2	2-3	2-3

Trackball Assembly 1984-1631-000x

Trackball Keyboard Parts Replacement

Part No.	Name	Replaces	Characteristics
10P52850004	Keyboard Electronics Board 68HCC05	1984-1975-000x 1984-2662-000x	EMC compliant. Can replace any other board
1984-2662-000x	Keyboard Electronics Board 68HCC05	10P52850004 1984-1975-000x	Keyboard Electronics boards are interchangeable except for EMC compliance
1984-1975-000x6	Keyboard Electronics Board	10P52850004 1984-2662-000x	Keyboard Electronics boards are Interchangeable except for EMC compliance
10P53240001 0002, 0003, 0009	Trackball Keyboard Replacement Subassembly	1984-1693-000x	EMC compliant. Use in any console. Replaces the keyboard top only. Has no base or cable
1984-1693-000x	Trackball Keyboard Replacement Subassembly	Keyboard top	Not EMC Compliant - Replaces keyboard top only. Has no base or cable
1984-1653-0003 Normal Trackball 1984-1653-0004 Teflon Sealed	Trackball	Trackball	Replaces the “black box” containing the trackball NOTE: Use the sealed version only where needed. It is much stiffer.

Option Keyboard 1984-1632-000x

Option Keyboard Electronics Board Parts Replacement

Part No.	Replaces	Name on PWA	Characteristics
1984-2871-000x	1984-1970-000x	KEYBOARD ELECTRONICS	EMC Compliant. Replaces any other board.
1984-1970-000x	1984-2871-000x	KEYBOARD ELECTRONICS	Fully interchangeable, except for EMC Compliance.

Keyboard Electronics Board Jumper Positions

Usage	HD1 (J1)	HD2 (J2)	HD3 (J3)	HD4 (J4)
Option Keyboard 1	1-2	1-2	1-2	2-3
Option Keyboard 2	1-2	1-2	2-3	1-2
Option Keyboard 3	1-2	1-2	1-2	1-2

Joystick **1984-3038-000x**
Touchpad **1984-2844-000x**
..... **1984-2321-000x**

Joystick Parts Replacement

Item	Part No.	Replaces	Characteristics
Joystick	1984-3038-000x		
Joystick Upgrade Kit	1984-3040-000x		Replaces the Touchpad.
Keyboard Electronics Board 68HCC05	10P52850004	1984-1975-000x 1984-2662-000x	EMC compliant. Can replace any other board
Keyboard Electronics Board 68HCC05	1984-2662-000x	10P52850004 1984-1975-000x	Keyboard Electronics boards are Interchangeable except for EMC compliance
Keyboard Electronics Board	1984-1975-000x	10P52850004 1984-2662-000x	Keyboard Electronics boards are Interchangeable except for EMC compliance

Touchpad Replacement

Item	Part No.	Characteristics
Touchpad	1984-2321-000x 1984-2844-000x	A Touchpad should be replaced with a Joystick upgrade kit.
Touchpad Keyboard Electronics Board	1984-1981-000x	A Touchpad Keyboard Electronics Board should be replaced with a Joystick upgrade kit.
Keyboard, Cursor Control (Modified)	1984-2335-000x	The membrane keyboard may be replaced with any dash number (-000x) keyboard assembly or with a Joystick upgrade kit.

Keyboard Electronics Board 1984-2871-000x
..... 1984-1970-000x

Keyboard Electronics Board Parts Replacement

Item	Part No.	Replaces	Characteristics
Keyboard Electronics board	1984-2871-000x	1984-1970-000x	Completely interchangeable
Keyboard Electronics board	1984-1970-000x	1984-2871-000x	Completely interchangeable

Keyboard Electronics Board Jumper Positions

Usage	HD1 (J1)	HD2 (J2)	HD3 (J3)	HD4 (J4)
Main Keyboard	1-2	1-2	2-3	2-3
Option Keyboard 1	1-2	1-2	1-2	2-3
Option Keyboard 2	1-2	1-2	2-3	1-2
Option Keyboard 3	1-2	1-2	1-2	1-2

Trackball Electronics Board 10P52850004
. . . . . 1984-2662-000x
. . . . . 1984-1975-000x

NOTE: Trackball Electronics Boards are completely interchangeable except that only 10P5285 can be used in a EMC compliant console.

Trackball Electronics Board Replacement

Name on PWA	Part No.	Replaces	Characteristics
TRACKBALL 68HC05	10P5285000x	1984-2662-000x 1984-1975-000x	EMC compliant. Useable in any console.
TRACKBALL 68HC05	1984-2662-000x	1984-1975-000x 10P5285000x	Not for an EMC compliant console.
TRACKBALL KEYBOARD	1984-1975-000x	1984-2662-000x 10P52850004	Not for an EMC compliant console.

Trackball Keyboard Replacement Subassembly

. . . . . 10P53240001
. . . . . 1984-1693-000x

Trackball Keyboard Replacement Subassembly

Name	Part No.	Replaces	Characteristics
Trackball Keyboard Replacement Subassembly	10P53240001	1984-1693-000x	EMC compliant. Useable in any console.
Trackball Keyboard Replacement Subassembly	1984-1693-000x	10P53240001	Not for an EMC compliant console.

Keyboard Interface 10P50842004
..... 1984-3222-x00x
..... 1984-2889-x00x
..... 1984-1978-000x

Keyboard Interface Parts Replacement

Part No.	Replaces	Name on PWA	Characteristics
10P50842004	1984-3222-2004	KEYBD INTERFACE/ VIDEO ISOLATOR	EMC compliant Password Security Software
1984-3222-2004	None	KEYBD INTERFACE/ VIDEO ISOLATOR	Password Security Software
10P50840004	1984-3222-0004 1984-2889-0004 1984-1978-000x	KEYBD INTERFACE/ VIDEO ISOLATOR	EMC compliant Standard Keyswitch only
1984-3222-0004	1984-2889-0004 1984-1978-000x	KEYBD INTERFACE/ VIDEO ISOLATOR	Standard Keyswitch or Dual Keyswitch (Uses 1984-3223-xxx Dual Keyswitch Cable)
1984-2889-0004	1984-1978-000x	KEYBD INTERFACE/ VIDEO ISOLATOR	Standard Keyswitch or Dual Keyswitch
1984-1978-000x	None	CONSOLE/ KEYBOARD INTERFACE	Standard Keyswitch No video isolation
1984-3222-1004	1984-2889-1004	KEYBD INTERFACE/ VIDEO ISOLATOR	Remote Keyswitch (Uses 1984-3267-xxxx Remote Keyswitch Cable)
1984-2889-1004	None	KEYBD INTERFACE/ VIDEO ISOLATOR	Remote Keyswitch (with pigtail cable)

Keyboard Interface LEDs

LED	Color	Meaning
DS1	Yellow	Flashes when receiving data from the printer interface
DS2	Yellow	Flashes when sending data to the printer interface
DS3	Red	Fuse F1 is blown

Keyboard Interface Jumper Setting

Jumper Position	Function
HD2 1-2 12.86↓	Console software is at revision 12.86 or lower (Not present on 1984-1978-000x)
HD2 2-3 12.90↑	Console software is at revision 12.90 or higher (Not present on 1984-1978-000x)
J414 Jumper wire	1984-3222-1004 only. Standard keyswitch application
J414 Dual keyswitch cable	1984-3222-0004 only. Dual keyswitch application

Keyboard Interface Fuses

Part No.	Name on PWA	Fuse	FRSI Part No.	Schurter Part No.	Littelfuse Part No.	Characteristics
1984-3222-000x 1984-2889-000x	Keybd Interface/ Video Isolator	F1	C50382-0021	MSF 034.4224	273002	2 A 125 V Plug-In
1984-1978-000x	Console/ Keyboard Interface	F1 F2	C50382-0021	MSF 034.4224	273002	2 A 125 V Plug-In

Multitube Command Console CRT

Conrac 7241 Components

Component	FRSI part number	Conrac part number
Scan Board (Selectable)	1984-1651-0018	162885-77
BNC (Selectable)	1984-1651-0033	162938-74A
Video Processor Board	1984-1651-0004	162838-72
High Voltage Module	1166-0524-0010	106513-6
Low Voltage Regulator Board	1984-1651-0007	162931-71
CRT Socket Board	1984-1651-0019	162921-72
Control Board	1984-1651-0020	162951-71

Adaptor Cables for Sony CRTs

Part No	Model No	Adaptor Cable
1984-3286-000x	CPD-1430	1984-3287-9500
1984-3246-000x	CPD-1304S C-1404S	1984-3245-0001
1984-2633-000x	CPD-1304	1984-3005-9030

Sony Monitor Adjustments

Control	Function
AUTO SIZE	Must be set to “ADJ” to enable use of the other controls.
H Size (horizontal size)	Used to adjust the horizontal size of the display.
H Shift (horizontal shift)	Used to adjust the center of the display horizontally.
V Size (vertical size)	Used to adjust the vertical size of the display**.**
V Cent (vertical center)	Used to adjust the center of the display vertically.

Pedestal Command Console
Keyboard Interface 1984-1782-000x
..... 1984-1921-000x

Command Console Key Map

Key Number	Keyboard	Part Number
1 - 26 32 - 63	Command Console Entry Keyboard	1984-1731-000x
64 - 68	Trackball and Cursor Control	1984-1779-000x
72 - 87	Block Configuration	1984-1776-000x
27 - 31 69 - 71	Not Used	- -

Keyboard Interface Parts Replacement

Part No.	Part Name on PWA	Replaces
1984-1921-000x	OS KEYBOARD INTERFACE	1984-1782-000x
1984-1782-000x	OI KEYBOARD INTERFACE	Itself

Pedestal Command Console CRT
Conrac 7211 ..... 1984-1872-000x

Conrac 7211 CRT Components

Component	Rosemount Part Number	Comment
Scan Board (15.75 kHz)	1166-0524-0016	
BNC (Differential)	1166-0524-0044	
Video Processor Board (Differential)	1166-0524-0045	
BNC (Single Ended)	1166-0524-0011	Replaced by 1984-0524-0044
Video Processor Board (Single Ended)	1166-0524-0012	Replaced by 1984-0524-0045
High Voltage Module	1166-0524-0010	
Low Voltage Regulator Board	1166-0524-0015	
CRT Socket Board	1166-0524-0013	
Rectifier and Filter Board	1166-0524-0014	
Control Board	1166-0524-0017	

Monochrome Video Generator 1981-1002-000x

LEDs for Monochrome Video Generator

LED	Meaning
DS1	Card good. No faults detected on the video generator card. Controller processor lights DS1 when power up diagnostics are completed.
DS2	Card fault. DS2 lights if the video generator card fails power up diagnostics.
DS3	Indicates that fuse F1, directing 12 volts to the CRT MONITOR, is bad.

Monochrome Video Generator Fuse

Fuse	Rosemount Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0032	MDL 2	313002	2 A 250 V Slow Blow

MiniConsole
Floppy Interface (SCSI) 1984-1053-000x

LEDs for MiniConsole Floppy Interface (SCSI)

LED	Meaning
DS1	Card Good. No faults are detected on the card.
DS2	Card Fault. A fault has been detected on the Interface card.
DS4	(Not used)
DS5	(Not used)
DS6	Write Data. The Interface card is writing to one of the Disk Drives.
DS7	Head Load. The read/write head on a disk drive is in the loaded position.
DS8	Read Data. Data is being transmitted from the disk drive to the Interface card.
DS9	Ready. The disk drive is sending a signal that it is ready for use.
DS10	Drive Sel 1. Disk drive number 1 is doing an active command.
DS11	Drive Sel 2. Disk drive number 2 is doing an active command.
DS12	CMD Request. A request for data to or from the drives is awaiting execution.
DS13	CMD Active. The system is currently sending a command for data transfer.
DS14	Retry. System is doing rereads or rewrites because of incomplete data on the first try.

Floppy Disk Power Supply 1984-1050-000x

Floppy Disk Power Supply Fuses

Fuse	Rosemount Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0011	MD1 1/4	- -	1/4 A 250 V Slow Blow
F2	G09140-0045	AGC 8	- -	8 A 250 V Regular

Hard Disk Drive

IBM Deskstar 540 ..... 10P5665000x
LPS 270S 10P52800002
LPS 170S 1984-3500-0002
LPS 105S 1984-3100-0002
80S 1984-2780-0001
Q280 1984-2307-0001
Q540 1984-1928-0001

Warning

The metal frame of the disk drive must not make electrical contact with the mounting frame in the console. Use either the black coated mounting can or use mylar insulating pads between the drive and the yellow can.

Hard Disk Drive Parts Replacement

Part No.	Replaces	Characteristics
10P5665000x	Itself only	3.5-inch disk IBM Deskstar 540 540 Meg Formatted
10P52800002	1984-3500-0002 1984-3100-0002	3.5-inch disk Quantum ProDrive LPS 270S 270 Meg Unformatted, Built-in SCSI
1984-3500-0002	1984-3100-0002	3.5-inch disk Quantum ProDrive LPS 170S 170 Meg Unformatted, Built-in SCSI
1984-3100-0002	1984-2780-000x 1984-2307-000x 1984-1928-000x	3.5-inch disk Quantum ProDrive LPS 105S 102 Meg Formatted
1984-2780-0001	1984-2307-000x 1984-1928-000x	3.5-inch disk Quantum ProDrive 80S 100 Meg Unformatted, 84 Meg Formatted
1984-2307-0001	1984-1928-000x	5.25-inch disk Quantum Q280 100 Meg Unformatted, 80 Meg Formatted
1984-1928-0001	Itself only	5.25-inch disk Quantum Q540 40 Meg

Cable 10P56840001 Inline Fuses Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 & F2	G01940-0046	AGC 10	311010	10 A 32 V Regular

IBM Deskstar 540 Jumpers

Jumper	Factory Setting
1	**ON** (Jumper)
2	OFF (No Jumper)
3	**ON** (Jumper)
4	OFF (No Jumper)
5	**ON** (Jumper)
6	**ON** (Jumper)
7	**ON** (Jumper)
8	OFF (No Jumper)
9	OFF (No Jumper)
10	OFF (No Jumper)
11	OFF (No Jumper)
12	OFF (No Jumper)

LPS and 80S Drive Address Jumpers

Jumper	Factory Setting
A0	**ON** (Jumper)
A1	OFF (No Jumper)
A2	**ON** (Jumper)

LPS 105S and 80S Drive Option Jumpers

Jumper	Purpose	Factory Setting
WS	Wait Spin Option	OFF (No Jumper)
EP	Enable Parity Option	**ON** (Jumper)
SS	Self Seek Test Option	OFF

Q280 Version 1 Drive Option Jumpers

Jumper	Purpose	Factory Setting
WS	Wait Spin Option	OFF (No Jumper)
EP	Enable Parity Option	**ON** (Jumper)
SS	Self Seek Test Option	OFF
R0		OFF
R1	No function	**ON**

Q280 Version 2 Drive Option Jumpers

Jumper	Purpose	Factory Setting
WS	Wait Spin Option	OFF (No Jumper)
EP	Enable Parity Option	**ON** (Jumper)
SS	Self Seek Test Option	OFF
P1	No function	**ON**
P2	No function	**ON**

Q280 Drive Address Jumpers

Drive Address	Jumper A0	Jumper A1	Jumper A2
0	OFF	OFF	OFF
1	**ON**	OFF	OFF
2	OFF	**ON**	OFF
3	**ON**	**ON**	OFF
4	OFF	OFF	**ON**
5	**ON**	OFF	**ON**
6	OFF	**ON**	**ON**
7	**ON**	**ON**	**ON**

Q540 Drive Jumpers

Jumper	Setting
A-B	**ON**
C-D	No Jumper
E-F	No Jumper
G-H	No Jumper
J-K	**ON**
DG	No Jumper
PAR	**ON**
A4	**ON**
A2	No Jumper
A1	**ON**

Floppy Disk Drive:
3.5-inch 1984-2837-000x

8-Bit Switch Setting

Switch	Position
1	OFF
2	OFF
3	OFF
4	OFF
5	**ON**
6	**ON**
7	**ON**
8	**ON**

4-Bit Switch Setting

Switch	Position
1	**ON**
2	**ON**
3	**ON**
4	OFF

Floppy Disk Drive:
5.25-inch 1984-1803-000x

5.25-Inch Floppy Disk Drive Parts Replacement

Part No.	Characteristics
1984-1803-000x	Kit includes drive and mounting hardware

Model	Jumper
Pansonic JU475-4AEG	DA, RDY, MS, GX, AX, BX, PH, TM **NOTE:** TM is removed for drive 2
Pansonic JU475-3AEG	NAX, MDA, BX, 1, OP, TM **NOTE:** TM is removed for drive 2
Pansonic JU475-2AEG	MS, DA, IX, BX, RD, AX, MX-DS (RIGHT), 1 NOTE: Resistor pack is removed for drive 2

Magnetic Tape Drive

Tandberg 5623 ..... 10P5685000x
Viper 2150S 1984-3389-000x
Viper 2060S 1984-3289-000x
Scorpion 5945S 1984-1989-000x
Scorpion 5945C 1984-1927-000x

Magnetic Tape Drive Parts Replacement

Part No.	Replaces	Characteristics
10P5685000x	1984-3389-000x	Tandberg tape drive with embedded SCSI controller. **NOTE:** The Tandberg can read tapes written by any of the drives below. Of the drives listed below, only the Viper 2150S can read tapes written by the Tandberg.
1984-3389-000x	1984-3289-000x 1984-1989-000x 1984-1927-000x	Viper 2150S tape drive with embedded SCSI controller. **NOTE:** The Viper 2150S can read tapes written by any of the drives below. The drives below CANNOT read tapes written by the Viper 2150S.
1984-3289-000x	1984-1989-000x 1984-1927-000x	Viper 2060S tape drive with embedded SCSI controller
1984-1989-000x	1984-1927-000x	Scorpion 5945S tape drive with embedded SCSI controller
1984-1927-000x	None	Scorpion 5945C tape drive with SCSI controller board

Drive	Jumper or Switches
Tandberg 5623	PARITY, 2, and TERMPWR ON
Viper 2150S Viper 2060S	BUFFER DISCONNECT SIZE (16K) CF2, CF0, ID2 ON
Scorpion 5945S	Switches 3, 5, 8 ON, all others OFF
Scorpion 5945C	Switches 1, 3, 5, 8 ON, all others OFF

Printer:
Fujitsu DPL24C 1984-0510-000x

Fujitsu DPL24C Printer Switch Settings

Dip Switch	1	2	3	4	5	6	7	8
A	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF	**ON**
B	**ON**	**ON**	OFF	OFF	OFF	OFF	OFF	OFF
C	OFF	OFF	OFF	OFF	OFF	OFF	(Don't care)	(Don't care)
D	**ON**	**ON**	**ON**	**ON**	OFF	**ON**	OFF	OFF

Fujitsu DL2600 Printer Paper Thickness

Paper	Notch
Single part, 10 pound	1 or 2
Two part	2
Three part	3
Four part	4
Ribbon removal	D

❑ **To set up the Fujitsu DL2600 printer:**

1. Hold down ALT and then press SETUP. The display shows “SET-UP MODE” and then “FUNCTION: STYLE”.
2. Press ITEM to enter the “style” level.
3. Press SELECT to display each of the items listed below. When the correct item is displayed, press ITEM to enter it in memory.

Fujitsu DL2600 Printer Setup

Item	Value		Item	Value
PPR OUT:	DETECT *		COLOR:	AUTOSEL *
LF-CODE:	LF ONLY		LINE SP:	6 LPI *
BUZZER:	ON *		PRF SKP:	NO *
QUALITY:	DRAFT		OFFSET:	0 *
ATTRIB:	NONE *		CR-CODE:	CR ONLY *
CHAR SP:	10 CPI *		PRT-DIR:	BI-DIR *

* indicates a factory setting

4. Press FUNCTION until “FUNCTION: INTERFACE” is displayed. Press ITEM to enter the “function” level.
5. Press SELECT to display each of the items listed below. When the correct item is displayed, press ITEM to enter it in memory.

Fujitsu DL2600 Printer Setup

Item	Value		Item	Value
TYPE:	SERIAL		PROTOCL:	XON/XOF
WORD LG:	8 BIT		DUPLEX:	FULL
FORMAT:	8NONE 1		CONTROL:	3 WIRE
BAUD RT:	4800			

6. Press FUNCTION until “FUNCTION SAVE” is displayed. Press ITEM to have the printer save the selected options in nonvolatile memory.
7. Press ONLINE to resume normal operation.

Printer:
Fujitsu DL3800 . . . . . 1984-3318-000x

❑ **To set up the Fujitsu DL 3800 printer:**

1. Have continuous form paper loaded. The setup procedure will require several sheets.
2. Put the printer in setup mode:

   Put the printer off-line (press ONLINE until the ONLINE light goes out). Press both the FONT and MENU buttons until the printer beeps.

   -or-

   Turn the printer off. Press both the FONT and MENU buttons. Turn the printer on. The printer will beep.
3. The printer will print a header describing the setup procedure, a Help menu, and the <<FUNCTION>> menu. The red cursor on the print guide is positioned at the SAVE&END function.
4. Press LOCK to move the cursor to the MENU1 function. Press FONT to select it. The printer will print the first item in the menu and the options for the item.
5. The cursor will stop at the option currently stored in memory. This option will have a short underline on the paper. Use LOCK to move the cursor to the desired option.
6. Use FONT to select the option. When an option is selected it is completely underlined. The next item in the menu is then printed.
7. Set MENU1 to the options shown below.
8. Press ONLINE to return to the <<FUNCTION>> menu. Press LOCK to position the cursor at MENU2. Press FONT to select MENU2. Set the options in MENU2 as shown below.

Fujitsu DL3800 Printer MENU1 and MENU 2 Options

Item	Option		Item	Option
EMULATE	DPL24+		TOP-MRG	1 LINE
FONT	COUR10		LANGUAGE	PAGE 437
QUALITY	DRAFT		CHR-SET	SET 2
PITCH	10 CPI		PRF-SKP	NO SKIP
LINE SP	6 LPI		WIDTH	13.6 IN
CHAR-W	NORMAL		ZEROFNT	NO-SLSH
CHAR-H	NORMAL		DC3-CDE	ENABLE
ATTRIB	NONE		CR-CODE	CR ONLY
PAGE LG	11.0 IN		LF-CODE	LF ONLY
COLOR	AUTOSEL		RGHTEND	WRAP
LFT-END	1 COLM			

– Continued –

9. Press ONLINE to return to the <<FUNCTION>> menu. Press LOCK to position the cursor at HARDWARE and press FONT to select it. Set options in the HARDWARE menu as shown below.

Fujitsu DL3800 Printer HARDWARE Menu Options

Item	Option		Item	Option
PPR-OUT	CNTONLY		INTRFCE	SERIAL
PRT-DIR	BI-DIR		FORMAT	8NONE1
BUZZER	ON		BAUE-RT	4800
WORD-LG	8-BIT		PROTOCL	XON/XOFF
BUFFER	8KB **NOTE:** Do not use a buffer size larger than 8 kB.		DSR	IGNORE
FEEDER	REAR		DUPLEX	FULL

10. Press ONLINE to return to the <<FUNCTION>> menu. Press LOCK to position the cursor at SAVE&END and press LOCK to select it. The configuration will be saved in memory. The printer will be in ONLINE mode, ready for use.
11. The printout is a record of the configuration. Selected options have full underlines. Options that were changed have a partial underline at the original value.

Printer:
Fujitsu DL4600 . . . . . 1984-0543-000x

❑ **To set up the Fujitsu DL4600 printer:**

1. Press “NEXT DISPLAY” until “enter setup” appears in the display window. Press F1, “Menu 1” appears in the display window. Scroll through the options and verify the settings shown below. Scroll with F2. Change options with F3.
2. Press F1, “Menu 2” appears in the display window. Scroll through the options and verify the settings. Menu 2 must be identical to Menu 1.

Fujitsu DL4600 Printer Setup

Menu Item	Value		Menu Item	Value
EMULATE	DPL24C		TOP-MRG	1 LINE
FONT	COUR10		LANGUAGE	USA
QUALITY	DRAFT		CHR-SET	SET 2
PITCH	10 CPI		PRT-SKIP	NO-SKIP
LINE SP	6 LPI		WIDTH	13.6 IN
CHAR-W	NORMAL		ZEROFNT	NO-SLASH
CHAR-H	NORMAL		DC3-CDE	ENABLE
ATTRIB	NONE		CR-CODE	CR ONLY
PAGE LG	11.0 IN		LF-CODE	LF ONLY
COLOR	AUTOSEL		RGHTEND	WRAP
LFT-END	1 COLM		=END=	

3. Press F1 until “Hardware Features” appears in the display window. Scroll through the options and verify the settings shown below. Scroll with F2. Change options with F3.

Fujitsu DL4600 Printer Setup

Menu Item	Value		Menu Item	Value
SensePE	REAR		FORMAT	8 NONE 1
PRT-DIR	BI-DIR		BAUD-RT	4800
BUZZER	ON		PROTOCOL	XON/XOF
WORD-LG	8 BIT		DSR	IGNORE
BUFFER	8 KB **NOTE:** Do not use a buffer size larger than 8 KB.		DUPLEX	FULL
FEEDER	REAR		=END=	
INTRFCE	SERIAL			

4. Press F1 until “Save” appears in the display window. Press F3 to save the configuration.
5. Press F1 until “Func LIST” appears. Press F3 to print the option lists. Verify the printed lists.
6. Press F1 until “Self Test” appears in the display window. Press F3 to start the test, press F2 to stop it after about 30 seconds. Press F1 to exit the self test.
7. Press the “ON LINE” button to resume normal operation.

Printer:
Texas Instruments 810 . . . . . 1984-0317-000x

TI 810 Processor Board Jumpers

Jumpers	Setting
E1-E2-E3	E2-E3
E4-E5-E6	E5-E6
E7-E8-E9	E8-E9
E10-E11-E12	E11-E12
E13-E14-E15	E13-E14
E16-E17-E18	E17-E18
E19-E20-E21	OPEN
E22-E23-E24	OPEN

TI 810 Printer Motherboard Jumpers

Jumpers	Setting
E1-E2	JUMPERED
E3-E4	JUMPERED
E11-E12-E13	E11-E12

TI 810 Printer Baud Rate (Pencil) Switches

Switch	Setting		Switch	Setting
1	ON		5	OFF
2	OFF		6	ON
3	ON		7	ON
4	OFF			

TI 810 Printer Voltage Checks

Test Point	Voltage	Tolerance
E4	+12 VDC	± .6 VDC
E5	-12 VDC	± .6 VDC
E6	+8 VDC	± 1 VDC
E7	-75 VDC	± 15 VDC
E8	-5 VDC	± .25 VDC
E9	+30 VDC	± 10 VDC
E10	+5 VDC	± .05 VDC

Alarm Output Board 1984-0744-000x

Alarm Output Board Fuses

Fuse	Rosemount Part No.	Bussman Part No.	Characteristics
F1 F2	G09140-0029	MDQ-1-1/2	1.5 A 250 V Slow Blow

PeerWay Interface 1984-1045-000x

LEDs for PeerWay Interface

LED	Meaning
DS1	Card Good: No faults are detected on the card.
DS2	Card fault: A fault has been detected in the communication link.
DS4	PW Tap ST A: The Timer in tap A has timed out.
DS5	PW Tap ST B: The Timer in tap B has timed out.
DS6	RTS: Ready to send generated from the PeerWay Interface.
DS7	Bus Active: The PeerWay Interface is receiving data.
DS8	A Active: The Interface is using the A PeerWay.
DS9	B Active: The Interface is using the B PeerWay.
DS10	CMD Active: Command active. The software is actively executing a command on the Interface Board.

PeerWay Interface Test Points

Test Point	Function
TP1	+5 V Isolated DC for Tap A
TP2	A return
TP3	+5 V Isolated DC for Tap B
TP4	B return

To set the jumpers for an address on PeerWay 1, set the jumpers so:

node address = (Sum of jumpers) + 2

To set the jumpers for use on PeerWay “P”:

Jumper setting = (Node Number) – 32(P–1)

PeerWay Interface Jumper Values

Jumper	Value at 1–2	Value at 2–3
HD1	2	0
HD2	4	0
HD3	8	0
HD4	16	0

OI Power Supply 1984-1137-000x

OI Power Supply Parts Replacement

Part No.	Replaces	Characteristics	Comment
1984-1137-000x	1984-1017-000x	24 V or 30 VDC Input. 12 V Output 3 Amps 5 V Output 20 Amps	Replaces any 1984-1017-000x.
1984-1017-000x		30 VDC Input. 12 V Output 2 Amps 5 V Output 11 Amps	

OI Power Supply LEDs

LED	Meaning
DS1	Card Good: Comparators are within tolerance.
DS2	Card fault: +5V or +12V comparator has sensed voltage out of tolerance.
DS3	Fuse F1 is bad: Regulator.
DS4	Fuse F2 is bad: Fan.
DS6	+5V Good: The +5V comparator is within tolerance.
DS7	+12V Good: The +12V comparator is within tolerance.
DS8	+30V Bus A Good: The 30VDC A power bus is within tolerance.
DS9	+30V Bus B Good: The 30VDC B power bus is within tolerance.

OI Power Supply Test Points

Test Point	Function
TP1-TP2 (Violet - Gray)	Isolated +9V A and Return
TP3-TP4 (Violet - Gray)	Isolated +9V B and Return
TP5-TP6 (Yellow - Brown)	+5 V and Return
TP7-TP8 (Red - Brown)	+12 V and Return

OI Power Supply Jumper Settings

Jumper HD1 Position	Input Voltage
1-2	30 VDC
2-3	24 VDC

OI Power Supply Fuses

Card	Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteris-tics
1984-1137-000x	F1	G09140-0047	AGC 15	311015	15 A 32 V Regular
	F2	G09140-0023	MDQ 1	313001	1 A 250 V Slow Blow
1984-1017-000x	F1	G09140-0044	AGC 7-1/2	31107.5	7.5 A 32 V Regular
	F2	G09140-0023	MDQ 1	313001	1 A 250 V Slow Blow

OI Processor

OI 68040 ..... 10P5527001x
..... 1984-3202-0010
OI 68020 1984-1540-0009
..... 1984-1161-0009
OI 68000 ..... 10P57140008
..... 1984-2759-0008
..... 1984-2137-0008
..... 1984-2122-0007
..... 1984-2120-0008
..... 1984-2107-0005
..... 1984-1061-0005

OI Processor Replacement Data

Part No.	Replaces	RAM	Used In	PWA Marked
10P55270011	- -	16 Meg	SMS	OI PROCESSOR V
10P55270010	1984-3202-0010	16 Meg	MTCC	OI PROCESSOR V
1984-3202-0010	1984-1540-0009* 1984-1161-0009*	16 Meg	MTCC	OI PROCESSOR V
1984-1540-0009 1984-1161-0009	All below*	4 Meg	MTCC HIA SCI	OI PROCESSOR 68020 W/ASIC OI PROCESSOR 68020
10P57140008	1984-2759-0008	2 Meg	MC CC MTCC HIA SCI	OI PROCESSOR III
1984-2759-0008	All below	2 Meg	MC CC MTCC HIA SCI	OI PROCESSOR III

* Use of this processor requires pixel graphics and may require changing software.

(continued on next page)

OI Processor Replacement Data (continued)

Part No.	Replaces	RAM	Used In	PWA Marked
1984-2137-0008	All below	1 Meg	MC BCC CC MTCC HIA SCI	OI PROCESSOR 1 MEG
1984-2122-0007	All below	1 Meg	BCC CC	OI PROCESSOR 1 MEG
1984-2120-0008	1984-2107-00051 984-1061-0005	1/2 Meg	MC BCC	OI PROCESSOR
1984-2107-0005	1984-1061-0005	1/2 Meg	MC BCC	OI PROCESSOR
1984-1061-0005		1/2 Meg	MC BCC	OI PROCESSOR

* Use of this processor requires pixel graphics and may require changing software.

OI Processor:
68040 ..... 10P5527001x
..... 1984-3202-0010

OI Processor 68040 LEDs

LED	Meaning
DS1	Card Good: No faults are detected on the card.
DS2	Card Fault: A fault has been detected on the Processor Card.
DS6	Display Active: Processor is updating Video Generator RAM.
DS7	Keyboard Active: Processor is operating on an instruction from a keyboard.
DS8	Controller I/O: Processor is working on a data update from a Controller.

OI Processor 68040 Jumper Positions

Jumper	Position 1-2	Position 2-3
HD1	Not used	Hard wired
HD2	Not used	Hard wired
HD3	PeerWay Boot	Disk Boot (Normal)
HD4	Not used	Hard wired
HD5	Not used	Hard wired
HD6	Not used	Hard wired

OI Processor:

68020 1984-1540-0009
. 1984-1161-0009

OI Processor 68020 LEDs

LED	Meaning
DS1	Card Good: No faults are detected on the card.
DS2	Card Fault: A fault has been detected on the Processor Card.
DS6	Display Active: Processor is updating Video Generator RAM.
DS7	Keyboard Active: Processor is operating on an instruction from a keyboard.
DS8	Controller I/O: Processor is working on a data update from a Controller.

OI Processor 68020 Jumper Positions

Jumper	Position 1-2	Position 2-3
HD3	PeerWay Boot	Disk Boot (Normal)
HD4	Not used	Factory set
HD5	Not used	Factory set

OI Processor:

OI 68000 ..... 10P57140008
..... 1984-2759-0008
..... 1984-2137-0008
..... 1984-2122-0007
..... 1984-2120-0008
..... 1984-2107-0005
..... 1984-1061-0005

OI Processor 68000 LEDs

LED	Meaning
DS1	Card Good: No faults are detected on the card.
DS2	Card Fault: A fault has been detected on the Processor Card.
DS3	Ext Loop Sel 30V Fuse: Fuse F1 is bad.
DS4	Fuse Blown: 5V Keyboard fuse blown.
DS6	Display Active: Processor is updating Video Generator RAM.
DS7	Keyboard Active: Processor is operating on a keyboard instruction.
DS8	Controller I/O: Processor is working on a data update from a Controller.

OI Processor 68000 Jumper Positions

Card	Jumper HD2 Position 2-3	Jumper HD2 Position 1-2
10P57140008 1984-2759-0008	No movable Jumpers	No movable Jumpers
1984-2137-0008 1984-2122-0007 1984-2120-0008 1984-2107-0005 1984-1061-0005	256K EPROM installed (Normal)	128K EPROM installed

OI Processor 68000 Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0036	MDL-3	313003	3A 250 V Slow Blow
F2	G09140-0041	MDL-5	312005	5 A 250 V Regular

Pixel Graphics Video Generator 1984-2503-0001

Pixel Graphics Video Generator LEDs

LED	Meaning
DS1 (Green)	No faults are detected on the card. DS1 lights when the OI Processor completes power up diagnostics.
DS2 (Red)	The Pixel Graphics Video Generator has a fault.
DS8 (Yellow)	The Graphics Processor on the Pixel Graphics Video Generator is executing commands. DS8 lights when the CRT screen is periodically updated.
DS9 (Yellow)	The specific area of memory where commands are stored is being used. When the Graphics Processor is finished executing commands, DS9 goes out and the command area can be accessed.
DS10 (Yellow)	The memory bus is in use. DS10 lights when the OI Processor is reading into or writing from the Pixel Graphics Video Generator memory.
DS11 (Yellow)	Text fields on the CRT screen are being updated. DS11 goes out after the fields are updated.
DS12 (Yellow)	Horizontal sync. Under normal operation, DS12 blinks at a regular rate.

Character Graphics Video Generator 1984-1064-0001

Character Graphics Video Generator LEDs

LED	Meaning
DS1 (Green)	No faults are detected on the card. DS1 lights when the OI Processor completes power up diagnostics.
DS2 (Red)	Card fault. DS2 lights if the Video Generator Card does not pass power up diagnostics.
DS3 (Red)	Not used.
DS6 (Yellow)	Page 0 is active. Page 0 and page 1 store information for the CRT display. Depending on the amount of screen information, either DS6 or DS7 lights, or both DS6 and DS7 light.
DS7 (Yellow)	Page 1 is active. Page 0 and page 1 store information for the CRT display. Depending on the amount of screen information, either DS6 or DS7 lights, or both DS6 and DS7 light.
DS8 (Yellow)	Hardware alarm contact. The signal sent to light DS8 has also been sent to open or close the hardware alarm contact.
DS9 (Yellow)	Process alarm contact. The signal sent to light DS9 has also been sent to open or close the process alarm contact.
DS10 (Yellow)	Diagnostic routine is in progress during a power up procedure.
DS11 (Yellow)	Screen blank is active. On a normally functioning Character Graphics Video Generator Card, DS11 shows a slight but constant flicker.

Character Graphics Video Generator Fuse

Fuse	Rosemount Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0032	MDL-2	312002	2A 250 V slow blow

Printer Interface 1984-1011-000x

Printer Interface Parts Replacement

Part No.	Replaces	Characteristics
1984-1011-0001 1984-1011-0002		No RS-422 Interface
1984-1011-0003 1984-1011-0004	1984-1011-0001 1984-1011-0002	RS-422 Interface for Multitube Consoles

Printer Interface Card -0001, -0002 (without RS-422 interface) LEDs

LED	Meaning
DS1	Card good. No faults are detected on the card.
DS2	Card fault. A fault has been detected in the communication link.
DS8	TXD. Indicates data being transmitted to the printer.
DS9	CTS. Clear To Send. Printer is connected and ready to accept data.
DS10	NV Write. The nonvolatile RAM is being written.
DS11	Clock. A one-second pulse that the RTC is running.
DS12	Software Clock. The internal software clock of the console is running.

Printer Interface Card -0003, -0004 (with RS-422 interface) LEDs

LED	Meaning
DS1	Card good. No faults are detected on the card.
DS2	Card fault. A fault has been detected in the communication link.
DS6	TXD A. Indicates data being transmitted to the keyboard.
DS7	CTS A. Clear To Send. Keyboard is connected and ready to accept data.
DS8	TXD B. Indicates data being transmitted to the printer.
DS9	CTS B. Clear To Send. Printer is connected and ready to accept data.
DS10	NV Write. The nonvolatile RAM is being written.
DS11	Clock. A one-second pulse that the RTC is running.
DS12	Software Clock. The internal software clock of the console is running.

Printer Interface Jumpers

Jumper	Position	Function
HD10	1-2	Clock battery connected (Operating position)
	2-3	Clock battery disconnected (Storage position)
HD1-HD6	M	Configured as Modem (Normal position)
HD7-HD9	N	Test disabled (Normal position)

SCSI (Small Computer System Interface) 1984-3301-0001
. 1984-1140-0001

SCSI Card Parts Replacement

Part No	Replaces	Characteristics
1984-3301-0001	1984-1140-000x **NOTE:** You cannot mix -3301 and -1140 boards in a MultiTube console.	Requires OI 68020 or 68040 Processor with boot ROM at least 9.xx (68020) or 10.xx (68040).
1984-1140-000x	Itself only	Cannot be used with a -1140 board in a MultiTube console.

NOTE: With a disk-only console, SCSI termination is required. Use 1984-3301-0001 with the proper termination jumper settings, or use 1984-1140-0003, which has termination resistors.

SCSI Card LEDs

LED	Meaning
DS1 (Green)	No faults are detected on the card. DS1 lights when the card has passed power up diagnostics.
DS2 (Red)	A fault has been detected on the card. DS2 lights when the card has failed power up diagnostics.
DS6 (Yellow)	SCSI bus is busy. DS6 is a hardware driven LED and will flicker under normal operation.
DS7 (Yellow)	Message or status information is being transferred on the SCSI bus. DS7 is driven by the target device and will flicker under normal operation. A steady ON indicates the bus is locked.
DS8 (Yellow)	Indicates data is being transferred to the tape or drive. DS8 is driven by a target device and will flicker under normal operation. A steady ON indicates the bus is locked.
DS9 (Yellow)	Indicates messages or commands are being transferred on the SCSI bus. DS9 is driven by a target device and will flicker under normal operation. A steady ON indicates the bus is locked.
DS10 (Yellow)	Direct memory access request. Indicates a data transfer between the disk or tape and SCSI Interface card.

(continued on next page)

SCSI Card LEDs (continued)

LED	Meaning
DS12 (Yellow)	Hard disk access. A command is being issued to the hard disk.
DS13 (Yellow)	Indicates a command is being issued to the tape drive. DS13 will blink every second as the tape drive is monitored for tape insertion or removal.
DS14 (Yellow)	Indicates cache memory on the SCSI board is being accessed. The most recently used disk sectors are stored in cache memory.

SCSI Board 2 (1984-3301-0001) ID Jumper Setting

SCSI Device ID	Put Jumper On	Used For
0	HD0	Card Cage A
1	HD1	Card Cage B
2	HD2	Card Cage C

SCSI Board 2 (1984-3301-0001) Bus Terminal Jumper Setting

HD3	Action
1–2	Enabled (disk-only console)
2–3	Disabled (Normal setting)

OI SCSI Host Adapter (1984-1140-0001) Device ID Jumper

SCSI Device ID	Put Jumper On	Used For
0	HD1	Card Cage A
1	HD2	Card Cage B or Command Console
2	HD3	Card Cage C
3–7	HD4–HD8	These device IDs are not used in Console Card Cages

OI SCSI Host Adapter (1984-1140-0001) Address Jumpers

SCSI Bus Address	HD9	HD10	HD11	Used For
0	2–3	2–3	2–3	Card Cage A
1	2–3	2–3	1–2	Card Cage B or Command Console
2	2–3	1–2	2–3	Card Cage C
3	2–3	1–2	1–2	Not used
4	1–2	2–3	2–3	Not used
5	1–2	2–3	1–2	Not used
6	1–2	1–2	2–3	Not used
7	1–2	1–2	1–2	Not used

OI Nonvolatile Memory

OI NV RAM 1984-1547-000x
OI Bubble 1984-1147-000x
OI Bubble SC 1984-1167-000x

OI NV Memory Replacement Data

Part No.	Replaces	Characteristics
1984-1547-0001 -0002	1984-1147-000x 1984-1167-000x	256K RAM Memory -0001 has X.25 -0002 has X.25 disabled
1984-1547-0003 -0004	1984-1147-000x 1984-1167-000x	512K RAM Memory -0003 has X.25 -0004 has X.25 disabled
1984-1167-0001 -0002	1984-1147-000x	256K Bubble Memory -0001 has X.25 -0002 has X.25 disabled
1984-1147-000x	-	Original 256K Bubble Memory Does not have X.25 capability

OI Bubble Memory 1984-1147-000x
. . . . . 1984-1167-000x

OI Bubble Memory LEDs

LED	Meaning
DS1 (Green)	No faults are detected on the card. DS1 lights when the card has passed power up diagnostics.
DS2 (Red)	A fault has been detected on the card. DS2 lights when the card has failed power up diagnostics.
DS6 (Yellow)	TXD for RS-422 channel.
DS7 (Yellow)	RXD for RS-422 channel.
DS8 (Yellow)	CTS for RS-422 channel.
DS9 (Yellow)	RXD for RS-232 channel.
DS10 (Yellow)	CTS for RS-232 channel.
DS11 (Yellow)	TXD for RS-232 channel.
DS12 (Yellow)	Status LED 1: Operation: Program Access Power-up Test: Low order bit of test number.
DS13 (Yellow)	Status LED 2: Operation: Writing to the Bubble. Power-up Test: Middle bit of test number.
DS14 (Yellow)	Status LED 3: Operation: Reading from the Bubble. Power-up Test: High order bit of test number.

OI Bubble LED Sequences

Status LEDs (DS12, 13, 14)	Failed Test
-- OFF OFF	Unable to initialize.
-- OFF **ON**	Write failure.
-- **ON** OFF	Read failure.
-- **ON** ON	Read or write failure.
ON ON ON	Both 30 VDC power supplies are bad.

OI Bubble Jumpers

Jumper	Value	Purpose
HD1 (BATT)	**ON**	Real Time Clock battery connected
	OFF	Real Time Clock battery disconnected
HD2 (BOOT SWAP)	T	No longer used by software
	N	No longer used by software
HD3 (SYNC)	1-2	Bubble test (Factory use only)
	2-3	Normal operation
HD4 (CS1)	1-2	Bubble test (Factory use only)

(continued on next page)

OI Bubble Jumpers (continued)

Jumper	Value	Purpose
	2-3	Normal operation
HD5 (SYNC)	1-2	Bubble test (Factory use only)
	2-3	Normal operation
HD6 (CS2)	1-2	Bubble test (Factory use only)
	2-3	Normal operation
HD7, HD10	N	Normal Communications (RS-232)
	T	Communications Loopback Test(RS-232)
HD8, 9, 11, 12, 13	M	Function as a Modem (RS-232)
	T	Function as a Terminal (RS-232)
HD14	-	Not Used
HD15, 16, 17, 18	T	Communications Loopback Test (RS-422)
	N	Normal Communications (RS-422)
HD19	DOWNLOAD	Address this board as Secondary (See text)
	NORMAL	Address this board as Primary (See text)
HD20	M	Function as a Modem (RS-422)
	T	Function as a Terminal (RS-422)
HD21	T	Function as a Terminal (RS-422)
	M	Function as a Modem (RS-422)

OI NV RAM 1984-1547-000x

OI NV RAM LEDs

LED	Meaning
DS1 (Green)	No faults are detected on the card. DS1 lights when the card has passed power up diagnostics.
DS2 (Red)	A fault has been detected on the card. DS2 lights when the card has failed power up diagnostics.
DS4 (Yellow)	Battery 1 is low. Replace both batteries (battery 1 first).
DS5 (Yellow)	Battery 2 is low. Replace both batteries (battery 2 first).
DS6 (Yellow)	TXD for RS-422 channel.
DS7 (Yellow)	RXD for RS-422 channel.
DS8 (Yellow)	CTS for RS-422 channel.
DS9 (Yellow)	RXD for RS-232 channel.
DS10 (Yellow)	CTS for RS-232 channel.
DS11 (Yellow)	TXD for RS-232 channel.
DS12 (Yellow)	Status LED 1: Operation: Program Access Power-up Test: Low order bit of test number.
DS13 (Yellow)	Status LED 2: Operation: Writing to the Bubble. Power-up Test: Middle bit of test number.
DS14 (Yellow)	Status LED 3: Operation: Reading from the Bubble. Power-up Test: High order bit of test number.

OI NV VAM LED Sequences

Status LEDs (DS12, 13, 14)	Meaning
OFF **ON** **ON**	Failure in read/write tests of RAM.
ON **ON** **ON**	Bad program length, failed SCI image checksum, or both 30 VDC power supplies are bad.

OI NV RAM Memory Test Points

Test Point	Color	Purpose
TP1 +5V1	Yellow	RS-422 isolated +5 V supply
TP2 IG1	Gray	RS-422 isolated ground
TP3 +5V2	Yellow	RS-232 isolated +5 V supply
TP4 IG2	Gray	RS-232 isolated ground
TP5 +9V	Purple	Comparator supply
TP6 B1C	White	Battery 1 current
TP7 B2C	Green	Battery 2 current
TP8 B1V	White	Battery 1 voltage
TP9 B2V	Green	Battery 2 voltage
TP10 GND	Brown	Logic ground

OI NV RAM Jumpers

Jumper	Value	Purpose
HD1 (BATT 1)	**ON**	Battery 1 Connected
	OFF	Battery 1 Disconnected
HD2 (BATT 2)	**ON**	Battery 2 Connected
	OFF	Battery 2 Disconnected

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OI NV RAM Jumpers (continued)

Jumper	Value	Purpose
HD3 (RTCPWR)	BAT&PS	Hardwired
	PS ONLY	
HD4 (NVM SIZE)	512 KB	Hardwired for number of RAM chips used
	256KB	Hardwired for number of RAM chips used
HD5 (PEERWAY BOOT)	PWAY	Force PeerWay boot
	NORM	Normal operation
HD7, HD10	R	Run Normal Communications (RS-232)
	L	Communications Loopback Test (RS-232)
HD8, 9, 11, 12, 13	M	Function as a Modem (RS-232) (Remove for Loopback Test)
	T	Function as a Terminal (RS-232) (Remove for Loopback Test)
HD15, 16, 17, 18	L	Communications Loopback Test (RS-422)
	R	Run Normal Communications (RS-422)
HD19 (BD ADRR DECODE)	2NDARY	Address this board as Secondary (See text)
	PRIMARY	Address this board as Primary (See text)
HD20	M	Function as a Modem (RS-422)
	T	Function as a Terminal (RS-422) (Hardwired for non-X.25 operation)
HD21	M	Function as a Modem (RS-422) (Hardwired for non-X.25 operation)
	T	Function as a Terminal (RS-422)

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ControlFiles

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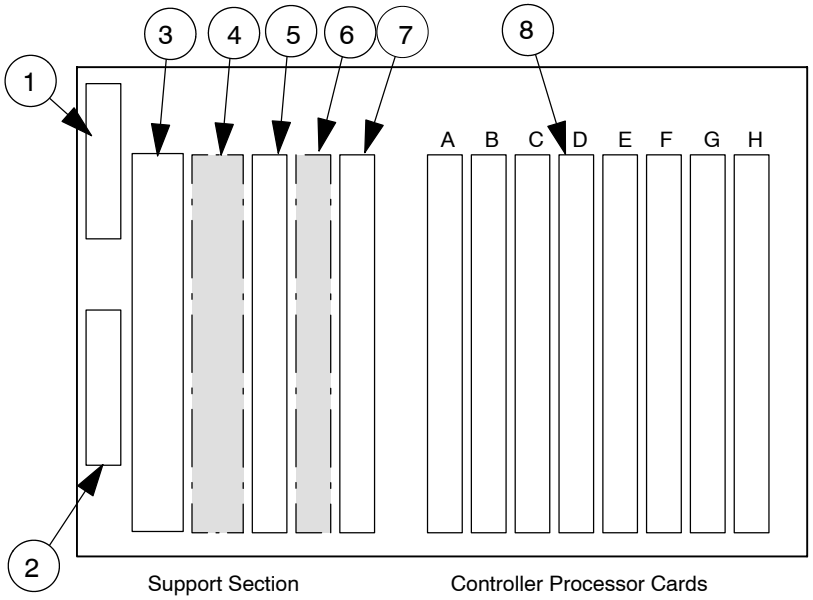
ControlFile Card Cage 10P52960001
. . . . . 1984-3048-000x
. . . . . 1984-0023-000x



ControlFile Cards

Item	Card	Item	Card
1	PeerWay Buffer A	5	Coordinator Processor (CP)
2	PeerWay Buffer B	6	Redundant Coordinator Processor (optional)
3	Power Regulator	7	Nonvolatile Memory
4	Second Power Regulator (optional)	8	Controller Processor A–H **NOTE:** Redundant processors must be installed in adjacent slots (AB, CD, EF, GH)

NOTE: 10P52960001 is EMC (CE) compliant and has built-in data bus terminators.

ControlFile Address Jumper Values

Jumper	Value at H	Value at L
5	16	0
4	8	0
3	4	0
2	2	0
1	1	0

NOTE: The Node Address is the sum of the jumpers plus 1.

PeerWay Buffer 1984-1502-000x
..... 1984-1402-000x

Parts Replacement for PeerWay Buffer

Part No.	Replaces	Characteristics
1984-1502-000x	1984-1402-000x	Marked “PEERWAY BUFFER” on the PWA
1984-1402-000x		No name marked on the PWA

PeerWay Buffer LEDs

LED	Meaning and Response
RTS (DS7)	Request-To-Send signal active; enables transmission on PeerWay.
TXD (DS6)	Transmitting to the PeerWay.
BUS ACTIVE (DS5)	Card active; Data is being transmitted or received through the Coordinator Processor.
+5 V FAULT (DS4)	PeerWay buffer voltage comparators sense that the main regulator is out of operating tolerance (high or low).
FUSE BLOWN (DS3)	Replace Fuse F1 (Supplies power to the PeerWay Buffer Power Regulator).
STATUS FAULT (DS2)	The status timer has timed out, indicating the RTS Signal has been enabled too long and the jabber-halt relay has opened. The RTS signal is forced OFF to keep the node from interfering with the PeerWay. The fault could be the status timer in the PeerWay Tap, the RTS signal on the Coordinator Processor, the Tap Board connection, or loss of the onboard clock, which is a PeerWay Buffer or Coordinator Processor problem.
STATUS GOOD (DS1)	The timer on the PeerWay Tap is in its normal operating mode.

PeerWay Buffer 1984-1502-000x Jumper Positions

Jumper	Signal	Normal	Loop Back Test
HD1	Not used	Not used	Not used
HD2	Receive Clock	2–3	1–2
HD3	Transmit Clock	2–3	1–2
HD4	Receive Data	2–3	1–2
HD5	Transmit Data	2–3	1–2
HD6	Ready to Send	2–3	1–2
HD7	BSL (Coupler Status)	2–3	1–2
HD8	Clear to Send	2–3	1–2

PeerWay Buffer Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09149-0022	AGC 1	312001	1 A 250 V Quick Acting

ControlFile Power Regulator 5 VDC Only 1984-3505-000x

ControlFile Power Regulator 5 VDC Only Parts Replacement

Part No.	Replaces	Characteristics
1984-3505-000x	1984-1505-000x 1984-1432-000x	Replaces these cards ONLY in ControlFiles that use NVRAM and MPC Processors.

ControlFile Power Regulator 5 VDC Only LEDs and Test Points

LED	Meaning and Response
+5 V POWER CHARGE (DS10)	Input capacitors are charging as you insert the card with card cage power on. Slowly insert the card into the ControlFile Motherboard connector (the LED will blink on briefly).
INPUT B STATUS (DS9)	Bus B (24 VDC or 30 VDC) from the DC distribution system is within operating tolerance. Normally OFF If only one DC bus used.
INPUT A STATUS (DS8)	Bus A (24 VDC or 30 VDC) from the DC distribution system is within operating tolerance.
+5 V STATUS (DS5)	The +5 VDC regulator is within operating tolerance.
CARD FAULT (DS4)	The +5 VDC regulator section is out of operating tolerance. *Replace the card.*
5 V FUSE BLOWN (DS2)	Replace Fuse F2 (Power to the +5 VDC Power Regulator).
CARD GOOD (DS1)	+5 VDC Supply is within operating tolerance. Does not include status of the DC buses.

Test Point	Function
BROWN	Ground return
YELLOW	+5 VDC Regulator
WHITE	+5 V Relative current indication

ControlFile Power Regulator 5 VDC Only Jumper Positions

Jumper HD1	Position 1-2	Position 2-3
30 V Input		**ON**
24 V Input	**ON**	

ControlFile Power Regulator 5 VDC Only Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F2	G09140-0061	ABC 20	314020	20 A 250 V Regular

ControlFile Power Regulator 5 and 12 VDC 1984-1505-000x
. . . . . 1984-1432-000x

ControlFile Power Regulator 5 and 12 VDC Parts Replacement

Part No.	Replaces	Characteristics
1984-1505-000x	1984-1432-000x	30 or 24 VDC input jumper-selected. 3 or 6 amp 12 VDC jumper-selected output
	1984-3505-0001	ONLY in a ControlFile with NVRAM

ControlFile Power Regulator 1984-1505-000x Jumper Positions

Jumper	30 V Input	24 V Input	3 Amp Output	6 Amp Output
HD1	2-3	1-2		
HD2			Open	Bar
HD3			Bar	Open
HD4			1-2	2-3
HD5			1-2	2-3

ControlFile 5 VDC Only Power Regulator Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 (12 VDC)	G09140-0044	AGC 7-1/2	31107.5	7.5 A 32 V Regular
F2 (5VDC)	G09140-0061	ABC 20	314020	20 A 250 V Regular

ControlFile Power Regulator 5 and 12 VDC LEDs and Test Points

LED	Meaning and Response
+12 V POWER CHARGE (DS11)	Input capacitors are charging as you insert the card with card cage power on. Slowly insert the card into the ControlFile Motherboard connector (+12 AND +5 V Power Charge LEDs will blink on briefly).
+5 V POWER CHARGE (DS10)	Same as +12 V Power Charge above.
INPUT B STATUS (DS9)	Bus B (24 VDC or 30 VDC) from the DC distribution system is within operating tolerance. Normally OFF If only one DC bus used.
INPUT A STATUS (DS8)	Bus A (24 VDC or 30 VDC) from the DC distribution system is within operating tolerance.
-12 V STATUS (DS7)	The -12 VDC regulator is within operating tolerance. If HD2 is jumpered, DS7 is forced ON and -12 VDC is disabled.
+12 V STATUS (DS6)	The +12 VDC regulator is within operating tolerance.
+5 V STATUS (DS5)	The +5 VDC regulator is within operating tolerance.
CARD FAULT (DS4)	One of the regulator sections (+5, +12, -12 VDC) is out of operating tolerance. Replace the card.
12 V FUSE BLOWN (DS3)	Replace Fuse F1 (+ 12 VDC supply sections of the Power Regulator).
5 V FUSE BLOWN (DS2)	Replace Fuse F2 (Power to the +5 VDC Power Regulator).
CARD GOOD (DS1)	+5, +12, and -12 VDC Supplies are within operating tolerance. Does not include status of the DC buses.

Test Point	Function
BROWN	Ground return
BLUE	-12 VDC Regulator
YELLOW	+5 VDC Regulator
RED	+12 VDC Regulator
WHITE	+5 V Relative current indication
GREEN	+12 V Relative current indication

CP (Coordinator Processor):

CP-IV+ 10P50870004
. . . . . 1984-4164-000x
CP-IV 1984-4064-000x
CP-II 1984-1594-000x
CP-I 1984-1448-000x
. . . . . 1984-1240-000x

Coordinator Processor Parts Replacement

Name	Part No.	Replaces	Characteristics
CP-IV+	10P50870004	1984-4164-000x 1984-4064-000x **NOTE:** For use with MPC I, MPC II, or MPC5	EMC compliant 64 MHz oscillator; 4 Meg RAM; 68020 microprocessor
CP-IV+	1984-4164-000x	1984-4064-000x **NOTE:** For use with MPC I, MPC II, or MPC5	64 MHz oscillator; 4 Meg RAM; 68020 microprocessor
CP-IV	1984-4064-000x	1984-4164-000x **NOTE:** for use with MPC II only	64 MHz oscillator; 4 Meg RAM; 68020 microprocessor
CP-II	1984-1594-000x	1984-1448-000x 1984-1240-000x	48 MHz oscillator; 512K RAM
CP-I	1984-1448-000x	1984-1240-000x	40 MHz Oscillator; 128K RAM
CP-I	1984-1240-000x		40 MHz Oscillator; 128K RAM

Coordinator Processor LEDs and Test Points

LED	Meaning and Response
TIC (DS10)	Beginning of a new time interval counter period (one tic is 1/4 second). The system operates on a 1/4 second data transfer rate for all PeerWay nodes (electrical drops).
CONT (DS9)	The Coordinator Processor is communicating with a Controller via the Motherboard. With redundant Coordinator Processors, this LED indicates which one is active.
BUS A (DS8)	The Coordinator Processor is using PeerWay A to transmit or receive data.
BUS B (DS7)	The Coordinator Processor is using PeerWay B to transmit or receive data.
RTS PEERWAY (DS6)	The Ready-To-Send signal is active and data is transmitting on one of the two PeerWays.
5 V FUSE BLOWN (DS3)	Replace Fuse F1 (Supplies 5 VDC to the Coordinator Processor).
CARD FAULT (DS2)	A fault has been detected on the Coordinator Processor, or the Enable/Disable Switch is in the DISABLE position. If the switch is ENABLED and this LED is on, replace the Coordinator Processor.
CARD ENABLE (DS1)	The Enable/Disable Switch is ENABLED and no hardware faults are detected on the Coordinator Processor.

Test Point	Function
Yellow	5 V (± 0.1 V)
Brown	Ground Return

CP Fault Indications

Yellow LED Conditions	Fault Condition: Green LED OFF, Red LED ON,
OFF OFF OFF **ON** OFF	1. CPU Test fault
OFF OFF **ON** OFF OFF	2. Boot ROM Checksum fault
OFF OFF **ON** **ON** OFF	3. Vector Test fault
OFF **ON** OFF OFF OFF	4. Watchdog Timer fault
OFF **ON** OFF **ON** OFF	5. Nondestructive RAM
OFF **ON** **ON** OFF OFF	6. Destructive RAM Test or EDAC fault
OFF **ON** **ON** **ON** OFF	7. Synch Bus Test Level 1 & 2 and checks on interrupts

CP Fault Indications

Yellow LED Conditions	Fault Condition: Green LED ON Then OFF, Red LED ON
ON OFF OFF OFF OFF	1. Nonvolatile Memory write test failed before the PeerWay boot procedure was performed. The Nonvolatile Memory card should be replaced.
ON OFF OFF **ON** OFF	2. No Nonvolatile Memory card is present or the Nonvolatile Memory card switch is in the DISABLE position.
ON OFF **ON** OFF OFF	3. Checksum invalid after load. If the problem persists, a nonvolatile memory reload from disk may be necessary.
ON OFF **ON** **ON** OFF	4. Uncorrectable error detected in CP card communications. Replace the CP card.
ON **ON** OFF OFF OFF	5. Nonvolatile memory initialize failed. Nonvolatile Memory card problem. See Chapter 10, Troubleshooting.
ON **ON** OFF **ON** OFF	6. Nonvolatile memory table checksum bad. Nonvolatile Memory card problem. See Chapter 10, Troubleshooting.
ON **ON** **ON** OFF OFF	7. No program image stored in the nonvolatile memory. See Chapter 10, Troubleshooting.

CP Fault Indications (continued)

Yellow LED Conditions	Fault Condition: Green LED ON Then OFF, Red LED ON
ON **ON** **ON** **ON** OFF	8. Nonvolatile Memory card hardware error on read. If the Nonvolatile Memory card was enabled, the card should be replaced.
ON OFF OFF **ON** OFF	9. No Nonvolatile Memory card is present or the Nonvolatile Memory card switch is set at DISABLE.

CP-IV+ Jumper Positions

Jumper	Position	Function
HD3 to HD6	1–2	Factory set – do not move
HD7	MPC II or MPC5 (1–2)	Working with MPC II or MPC5 Controller Processors only (Factory Setting)
	OTHER (2–3)	Working with MPC I Controller Processors or a mix of MPC I and MPC II

CP-IV Jumper Position

Jumper	Position	Function
HD3 to HD6	1–2	Factory set – do not move

CP-II Software Jumper Positions

Software	Jumper HD8	Jumper HD16
$$CPBATxx	2–3	2–3
$$CPxx V9	1–2	1–2
$$CPMAXXxx V9 and above $$CPxx V11 and above	2–3	1–2

CP-II Factory Set Jumpers

Jumper	Position
HD2	2-3
HD5	1-2
HD7	1-2
HD10 through HD15	Open

CP-I Factory Set Jumpers

Jumper	Position
HD2	2-3
HD5	2-3
HD7	1-2

CP Fuses

Card	Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteris-tics
CP-IV+ 10P50870004 1984-4164-000x	F1	G09140-0041	MTH 5	312005	5 A 250 V Regular
CP-IV 1984-4064-000x	F1	G09140-0041	MTH 5	312005	5 A 250 V Regular
CP-II 1984-1594-000x	F1	G09140-0039	AGC 5	311005	5 A 32 V Regular
CP-I 1984-1448-000x	F1	G09140-0037	AGC 4	311004	4 A 32 V Regular
CP-I 1984-1240-000x	F1	G09140-0037	AGC 4	311004	4 A 32 V Regular

NV (Nonvolatile) Memory:
RAM 1984-2347-000x

CAUTION

Disable the NV Memory and then the Coordinator Processor cards before removing any card (other than a PeerWay Buffer card) from the ControlFile. Failure to do so may result in a corrupted data transfer.

RAM NV Memory Parts Replacement

Part No.	Replaces	Memory	Board Marked
1984-2347-0041		4 Megabyte RAM	NV MEMORY
1984-2347-0021	Any card below	2 Megabyte RAM	NV MEMORY
1984-2347-0011	Any card below	1 Megabyte RAM	NV MEMORY

RAM NV Memory LEDs and Test Points

LED	Meaning and Response
BATTERY 2 LOW (DS10)	Battery 2 voltage is low. Replace both batteries. (One at a time)
BATTERY 1 LOW (DS9)	Battery 1 voltage is low. Replace both batteries. (One at a time)
PROGRAM ACCESS (DS8)	The Coordinator Processor is accessing the main operating programs of a Controller Processor or itself. The CP is reading from Nonvolatile memory to download data to a card, or is writing to Nonvolatile memory from the ControlFile.
WRITE (DS7)	The Coordinator Processor is writing to the Nonvolatile memory.
READ (DS6)	The Coordinator Processor is reading the Nonvolatile memory.

(continued on next page)

RAM NV Memory LEDs and Test Points (continued)

LED	Meaning and Response
+5 VDC BAD (DS3)	Replace Fuse F1.
CARD BAD (DS2)	Enable/Disable switch is set at DISABLE or the card failed power-up diagnostics.
CARD GOOD (DS1)	Card passed power-up diagnostics.

Test Point	Function
Brown	Ground Return
Yellow	+5 VDC
Green	Voltage of Battery #2
White	Voltage of Battery #1

NV RAM LED Sequence

Yellow LED Pattern	Fault Condition: Red "Card Bad" LED ON Green LED OFF
OFF OFF OFF	0 MC68000 Microprocessor test
OFF OFF **ON**	1 EPROM checksum test
OFF **ON** OFF	2 Program & Dual Port ROM test
OFF **ON** **ON**	3 Watchdog Timeout test

(continued on next page)

NV RAM LED Sequence (continued)

Yellow LED Pattern	Fault Condition: Red "Card Bad" LED ON Green LED OFF
ON OFF OFF	4 Not used
ON OFF **ON**	5 Interrupt test
ON **ON** OFF	6 Parallel Interface test
ON **ON** **ON**	7 Not used

RAM NV Memory Battery Jumper Positions

Jumper	Position	Action
HD6	1-2	Battery 2 enabled
	2-3	Battery 2 disabled
HD7	1-2	Battery 1 enabled
	2-3	Battery 1 disabled

RAM NV Memory Jumper Positions

Card	HD3	HD4	HD5	Characteristics
1984-2347-0011	1-2	1-2	1-2 Hard wired	1 Meg RAM
1984-2347-0021	1-2	2-3	1-2 Hard wired	2 Meg RAM
1984-2347-0041	- -	2-3 Hard wired	2-3 Hard wired	4 Meg RAM

RAM NV Memory Fuse Data

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0037	AGC 4	311004	4 A 32 V Regular

NV (Nonvolatile) Memory:
Bubble 1984-1598-000x
. . . . . 1984-1483-000x
. . . . . 1984-1224-000x

CAUTION

Disable the NV Memory and then the Coordinator Processor cards before removing any card (other than a PeerWay Buffer card) from the ControlFile. Failure to do so may result in a corrupted data transfer.

Bubble NV Memory Parts Replacement

Part No.	Replaces	Memory	Board Marked
1984-1598-0001	Any card below	1 Megabyte Bubble	4 MEG NV BUBBLE MEMORY (**NOTE:** This is 4 Megabits, which gives 1 Megabyte of useable memory)
1984-1483-000x	1984-1224-000x	1/2 Megabyte Bubble	NV BUBBLE MEMORY
1984-1224-000x	--	1/2 Megabyte Bubble	NV BUBBLE MEMORY

Bubble NV Memory LEDs and Test Points

LED	Meaning and Response
PROGRAM ACCESS (DS8)	The Coordinator Processor is accessing the main operating programs of a Controller Processor or itself. The card is reading from Nonvolatile Memory to download data to a card, or is writing to the memory card from the disk drive.
WRITE (DS7)	The Coordinator Processor is writing to the Nonvolatile Memory Card.
READ (DS6)	The Coordinator Processor is reading the Nonvolatile Memory Card.
12 V FUSE BLOWN (DS4)	Replace Fuse F2 (Supplies 12 VDC to the card).

Bubble NV Memory LEDs and Test Points

LED	Meaning and Response
5 V FUSE BLOWN (DS3)	Replace Fuse F1 (Supplies 5 VDC to the card).
CARD FAULT (DS2)	A fault is detected on the nonvolatile memory or the Enable/Disable Switch is DISABLED. If the switch is ENABLED and this LED is ON, replace the card.
CARD ENABLED (DS1)	The Enable/Disable switch is ENABLED and no hardware faults are detected on the Nonvolatile Memory card.

Test Point	Function
Yellow	+5 V (± 0.1 V)
Red	+12 V (± 0.1 V)
Brown	Ground Return

Bubble NV Memory Fuses

Card	Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteris-tics
1984-1598-000x	F1	G09140-0060	MTH 4	312004	4 A 250 V Regular
	F2	G09140-0041	MTH 5	312005	5 A 250V Regular
1984-1483-000x	F1	G09140-0060	MTH 4	312004	4 A 250 V Regular
	F2	G09140-0030	AGC 2	312002	2 A 250 V Quick Acting
1984-1224-000x	F1	G09140-0038	MDL 4	313004	4 A 250V Slow Blow
	F2	G09140-0030	AGC 2	312002	2 A 250 V Quick Acting

Controller Processor:

MPC5 ..... 10P57520007
MPC II 10P50400006
..... 1984-4068-000x
MPC 1984-2500-000x
MLC 1984-1439-000x
..... 1984-1249-000x
SSC 1984-1442-000x
..... 1984-1371-000x
CC 1984-1445-000x
..... 1984-1374-000x
MUX and PLC 1984-1494-000x

Controller Processor Parts Replacement

Name	Part No.	Replaces	Characteristics
MPC5	10P57520007	- -	MPC Multipurpose
MPC II	10P50400006 1984-4068-000x	1984-2500-000x	MPC Multipurpose
		1984-1445-000x 1984-1374-000x	CC Contact
MPC	1984-2500-000x	1984-1494-000x	MUX and PLC
		1984-1445-000x 1984-1374-000x	CC Contact
		1984-1494-000x	MUX and PLC
MLC	1984-1439-000x	1984-1249-000x	MLC MultiLoop
SSC	1984-1442-000x	1984-1371-000x	SSC Single-Strategy
CC	1984-1445-000x	1984-1374-000x	CC Contact
MUX PLC	1984-1449-000x	Itself only	MUX and PLC

Controller Processor LEDs and Test Points

LED	Meaning and Response
5 V Fuse Blown (DS3)	Replace Fuse F4 (Supplies 5 VDC to the Contact Processor).
Card Fault (DS2)	A fault has been detected on the Contact Processor, or the ENABLE/DISABLE Switch is in the DISABLE position. If the switch is enabled and this LED is on, replace the Contact Processor.
Card Enable (DS1)	The ENABLE/DISABLE Switch is enabled and no hardware faults are detected on the Contact Processor.
Block Evaluation (DS8)	The microprocessor is evaluating an input or output block. With redundant Contact Processors, this LED indicates the active card.
CP Access (DS7)	The Coordinator Processor is accessing the Contact Processor's RAM memory and transferring configuration and dynamic data to the NV Memory. If the Contact Processor loses memory, current data is quickly reloaded from NV Memory.
Interrupt (DS6)	The Contact Processor is resetting its watchdog timer to prevent timing out or to acknowledge the synchronizing clock pulse.

Test Point	Function
Yellow	+5 V (± 0.1 V)
Brown	Ground Return

Controller Processor Fault Indications

Yellow LED Conditions	Fault Condition
OFF OFF **ON**	CPU Test Fault
OFF **ON** OFF	Boot ROM Checksum Fault
OFF **ON** **ON**	Vector Test Fault
ON OFF OFF	Watchdog Timer
ON OFF **ON**	Nondestructive RAM
ON **ON** OFF	Destructive RAM Test or EDAC Fault
ON **ON** **ON**	Sync Bus Test Levels 1 & 2 and Checks on Interrupts

Controller Processor:
MPC5 ..... 10P57520007

MPC5 Controller Processor Parts Replacement

Name	Part No.	Replaces	Characteristics
MPC5	10P57520007	- -	Replaces itself (Requires jumper setting)

Jumpers for MPC5 Processor Functionality

Image Select	HD6	HD7	HD8
Additional Image #1	1-2	1-2	1-2
Additional Image #2	1-2	2-3	2-3
Additional Image #3	1-2	2-3	1-2
Additional Image #4	1-2	1-2	2-3

ControlFile Status Screen Jumper Code

Jumper Code	Image Selection	MPC5 Image Functionality
145	Additional Image #2	MUX5
146	Additional Image #2	PLC5
147	Additional Image #2	MPC5
155	Additional Image #3	MUX5
156	Additional Image #3	PLC5
157	Additional Image #3	MPC5
165	Additional Image #4	MUX5
166	Additional Image #4	PLC5
167	Additional Image #4	MPC5
175	Additional Image #1	MUX5
176	Additional Image #1	PLC5
177	Additional Image #1	MPC5

MPC5 Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0034	ACG 3	312003	3 A 250 V Regular

Controller Processor:
MPC II 10P50400006
..... 1984-4068-000x

MPCII Controller Processor Parts Replacement

Name	Part No.	Replaces	Characteristics
MPC II	10P50400006 1984-4068-000x	1984-2500-000x 1984-1439-000x 1984-1249-000x 1984-1442-000x 1984-1371-000x 1984-1445-000x 1984-1374-000x 1984-1494-000x	Replaces MPC as well as CC, PLC, and MUX Controller Processors (Requires jumper setting)

MPC II Communication Rate Jumper

Communication Rate	HD21	HD22	HD23	HD24
Rosemount 10.4 K Baud	2-3	2-3	2-3	2-3
Industry Standard	1-2	1-2	1-2	1-2

MPC II Processor Functionality Jumper

Processor Functionality	HD2
MPC II	1-2
MPC	2-3

Jumpers for MPC Processor Functionality

Image Select	HD6	HD7	HD8
Contact (CC)	2-3	2-3	1-2
Multiplexor (MUX)	2-3	1-2	1-2
Additional Image #1	1-2	1-2	1-2
Additional Image #2	1-2	2-3	2-3
Additional Image #3	1-2	2-3	1-2
Additional Image #4	1-2	1-2	2-3

Jumpers for MPC II Processor Functionality

Image Select	HD6	HD7	HD8
Additional Image #1	1-2	1-2	1-2
Additional Image #2	1-2	2-3	2-3
Additional Image #3	1-2	2-3	1-2
Additional Image #4	1-2	1-2	2-3

Jumpers for MPC2+ Image Functionality

MPC II+ Image Functionality	HD4	HD5	HD9
MPC+	1-2	1-2	1-2
PLC+	1-2	1-2	2-3
MUX+	1-2	2-3	1-2

ControlFile Status Screen Jumper Code (Visible with MPC II Image only)

Jumper Code	Processor Functionality	Image Selection	MPC II+ Image Functionality
0xx (Red)	MPC I	Jumper HD2 is set for MPCI functionality with an MPCII image	
145	MPC II	Additional Image #2	MUX+
146	MPC II	Additional Image #2	PLC+
147	MPC II	Additional Image #2	MPC+
155	MPC II	Additional Image #3	MUX+
156	MPC II	Additional Image #3	PLC+
157	MPC II	Additional Image #3	MPC+
165	MPC II	Additional Image #4	MUX+
166	MPC II	Additional Image #4	PLC+
167	MPC II	Additional Image #4	MPC+
175	MPC II	Additional Image #1	MUX+
176	MPC II	Additional Image #1	PLC+
177	MPC II	Additional Image #1	MPC+

MPC II Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0041	MTH 5	312005	5 A 250 V Regular

Controller Processor
MPC 1984-2500-000x

MPC Parts Replacement

Name	Part No.	Replaces	Characteristics
MPC	1984-2500-000x	1984-1439-000x 1984-1249-000x	MLC MultiLoop
		1984-1442-000x 1984-1371-000x	SSC Single-Strategy
		1984-1445-000x 1984-1374-000x	CC Contact
		1984-1494-000x	MUX and PLC

MPC Image Jumper Positions

Image	Jumper HD6	Jumper HD7	Jumper HD8
Contact	2-3	2-3	1-2
Multiplexer	2-3	1-2	1-2
Additional Image #1	1-2	1-2	1-2
Additional Image #2	1-2	2-3	2-3
Additional Image #3	1-2	2-3	1-2
Additional Image #4	1-2	1-2	2-3

MPC Communications Jumper Positions

Communication Rate	Jumper HD21	Jumper HD22	Jumper HD23	Jumper HD24
Rosemount 10.4K Baud	2-3	2-3	2-3	2-3
Industry Standard (9600 Baud)	1-2	1-2	1-2	1-2

MPC Fuse

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1	G09140-0041	MTH 5	312005	5 A 250 V Regular

Controller Processor:

MLC 1984-1439-000x
. . . . . 1984-1249-000x
SSC 1984-1442-000x
. . . . . 1984-1371-000x
MUX and PLC 1984-1494-000x

LEDs and Test Points

LED	Meaning and Response
12 V Fuse Blown (DS10)	Replace Fuse F1 (Supplies -12 VDC to the card).
+12 V Fuse Blown (DS9)	Replace Fuse F2 (Supplies +12 VDC to the card).
Block Evaluation (DS8)	The microprocessor is evaluating an input or output block. With redundant MultiLoop processors, this LED indicates which one is active.
CP Access (DS7)	The Coordinator Processor is accessing the MultiLoop Processor RAM Memory and transferring configuration and dynamic data to the NV Memory. If the MultiLoop Processor loses memory, current data is quickly reloaded from nonvolatile memory.
Interrupt (DS6)	The MultiLoop Processor is resetting its watchdog timer to prevent timing out or to acknowledge a synchronizing clock pulse.
5 V Fuse Blown (DS3)	Replace Fuse F4 (Supplies 5 VDC to the MultiLoop Processor).
Card Fault (DS2)	A fault has been detected on the MultiLoop Processor or the ENABLE/DISABLE Switch is in the disable position. If the switch is enabled and this LED is on, replace the MultiLoop Processor.
Card Enable (DS1)	The ENABLE/DISABLE Switch is enabled and no hardware faults are detected on the MultiLoop Processor.

Test Point	Function
Yellow	+5 V (± 0.1 V)
Red	+12 V (± 0.1 V)
Brown	Ground Return

Image Jumper Positions

Image	Jumper HD6	Jumper HD7	Jumper HD8
Contact	2–3	2–3	1–2
Multiplexer	2–3	1–2	1–2
Additional Image #1	1–2	1–2	1–2
Additional Image #2	1–2	2–3	2–3
Additional Image #3	1–2	2–3	1–2
Additional Image #4	1–2	1–2	2–3

Image Jumper Positions for MLC and SS

Image	Jumper HD6	Jumper HD7	Jumper HD8
MLC (MultiLoop Controller)	2–3	2–3	2–3
SS (Single Strategy)	2–3	2–3	2–3

Communications Jumper Positions

Communication Rate	Jumper HD21	Jumper HD22	Jumper HD23	Jumper HD24
Rosemount 10.4K Baud	2–3	2–3	2–3	2–3
Industry Standard (9600 Baud)	1–2	1–2	1–2	1–2

Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 F2	G09140-0016	AGC 1/2	312.500	1/2 A 250 V Quick Acting
F1 F4	G09140-0041	MTH 5	312005	5 A 250 V Regular

Section 7:
Input/Output

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Analog Card Cage Field Interface Cards:
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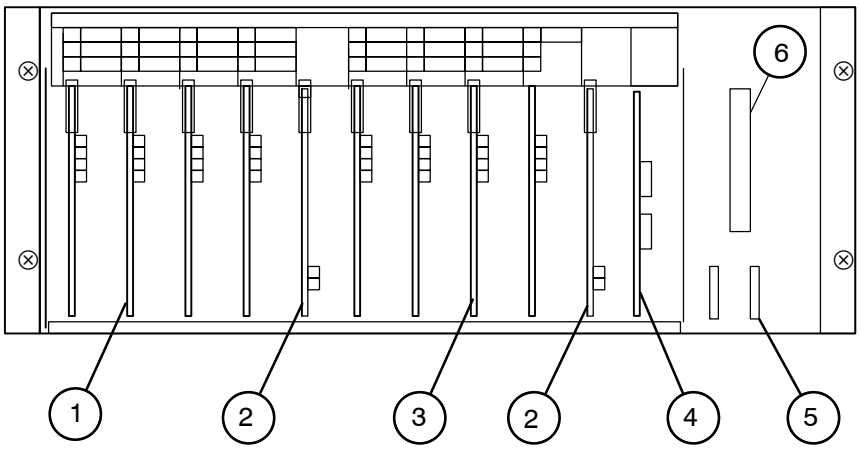

Analog Card Cage

Item	Name
1	FIC (Field Interface Card) 1-4
2	Analog Transfer Card or Output Bypass Card
3	FIC (Field Interface Card) 5-8
4	Communication Connect Card (Connects to ControlFile and provides 8 Communication Lines)
5	Power Connectors
6	Marshaling Panel Connector

NOTE: Redundancy:
- 7-1 Redundant FIC in Slot 8 (for FIC 1-7)
- 3-1 Redundant FIC in Slot 4 (for FIC 1-3) or 8 (for FIC 5-7)
- 1-1 Redundant FIC in adjacent slot 1-2, 3-4, 5-6, or 7-8

Communications Connect Card V (EMC Compliant) 10P54560001
Communications Connect Card IV 10P54530001
Communications Connect Card III 1984-2543-000x

Warning

The transient suppression networks are sufficient for cables within a building. For runs between buildings, put lightning arrestors where the cable enters the building. FRSI recommends metal conduit or a copper ground wire. (Or use a Fiber Optic I/O Converter.)

Cage Address Jumper Positions

Card Cage Address	Jumper HD1	Jumper HD2
A	1-2 ZERO	1-2 ZERO
B	2-3 ONE	1-2 ZERO
C	1-2 ZERO	2-3 ONE
D	2-3 ONE	2-3 ONE

Controller Redundancy Jumper Positions

Jumper	Controller Not Redundant	Controller Redundant
HD4 A HD4 B	1-2 NORMAL	2-3 REDUNDANT

Jumper	Card Cage in ControlFile Area	Card Cage in Remote Location
HD5	2-3 CONTROL FILE AREA	1-2 REMOTE I/O

Communications Connect Card II 1984-2491-000x

Cage Address Jumper Positions

Card Cage Address	Jumper HD1	Jumper HD2	Applies to:
A	1-2 ZERO	1-2 ZERO	Analog Card Cages
B	2-3 ONE	1-2 ZERO	Analog Card Cages
C	1-2 ZERO	2-3 ONE	Analog Card Cages
D	2-3 ONE	2-3 ONE	Analog Card Cages

Comm Line Select Jumper Positions

Jumpers A-J	No of Comm Lines Connected
2-3	1-8

Controller Redundancy Jumper Positions

Jumper	Controller Not Redundant	Controller Redundant
HD4 A HD4 B	1-2 NORMAL	2-3 REDUNDANT

Location Jumper Positions

Jumper	Card Cage in ControlFile Area	Card Cage in Remote Location
HD5	2-3 CONTROL FILE AREA	1-2 REMOTE I/O

Analog Transfer Card 1984-2494-0001

Analog Transfer Card LEDs

LED	Meaning
DS2 (Red)	30V Fuse Blown
DS1 (Green)	+5V Status: The card has power and the regulator is operational.

During a transfer card test, completely disconnect the leads at each point. Failing to disengage leads before going to the next point may damage the Transfer Card.

Test Points for Analog Transfer Card

Test Point	Function
101 501	Slot 1 or 5, Point 1
102 502	Slot 1 or 5, Point 2
103 503	Slot 1 or 5, Point 3
201 601	Slot 2 or 6, Point 1
202 602	Slot 2 or 6, Point 2
203 603	Slot 2 or 6, Point 3
301 701	Slot 3 or 7, Point 1
302 702	Slot 3 or 7, Point 2
303 703	Slot 3 or 7, Point 3
401 801	Slot 4 or 8, Point 1
402 802	Slot 4 or 8, Point 2
403 803	Slot 4 or 8, Point 3

Analog Transfer Card Fuse Data

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0014	273.500	MSF 034.4216	1/2 A 125 V Plug-In

Output Bypass Card (OBC) 1984-2551-0001

Output Bypass Card Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littel-fuse Part No.	Schurter Part No.	Characteristics
F1	G09140-0030	AGC 2	312002	- -	2 A 250 V Quick Acting
F2	G50382-0009	- -	273.125	MSF 034.4210	1/8 A 125 V Plug-In

Analog Card Cage Field Interface Cards:
Analog FIC (EMC Compliant) 10P54440002
Analog FIC 1984-2518-0002

Analog FIC Specifications

Item	Specification
Temperature	0–50° C
Humidity	10–90%
Power Supply voltage	Nominal 24 VDC to 30 VDC, Minimum 22 VDC, Maximum 34 VDC, Minimum Battery Backup 18 VDC
Current (typical)	At 30 VDC 214 mA; At 24 VDC 260 mA; At 18 VDC 347 mA
Accuracy	.1% of span
Resolution over 4–20 mA span	Input (A/D) 13 bits (0.012%) Output (D/A) 12.4 bits (0.019%)
Drift/Temperature	.1 % of span from 25° C to any temperature in 0–50° range

Analog FIC LEDs

LEDs	Meaning
DS1	Card Good: No card faults are detected and the controller processor card is controlling the output current. Blinking LED indicates the FIC is not connected to the field (I/O redundancy) or the output is being controlled by the Output Bypass card.
DS2	Card Fault: A card fault is detected or communications with the Controller Processor card have ceased.
DS3	TX Enable: Indicates communications activity. The signal that enables the transmit signal from the Field Interface card to the Controller Processor card is active.
DS4	30V Fuse Blown: Power fuse F1 has blown. This LED does not indicate the status of the fuses in the I/O loops. All fuses are installed in sockets and are removable without soldering.

Analog FIC Jumper Positions

Jumper	Value	Action
FAIL HD1	HOLD 1-2	Hold output on failure
	ZERO 2-3	Zero output on failure
OUT HD2	NORM 1-2	Normal output action (Jumper not used by software. Leave in the 1-2 position.)
	REV 2-3	Reversed output action (Jumper not used by software.)
REDUNDANCY	1-2	1-7 redundancy or no redundancy
HD4 HD5 (Rev A)	2-3	1-1 redundancy
PWR	SYS 1-2	System power for external devices
HD11, HD21, HD31	SELF 2-3	External devices are self powered

Analog FIC Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0021	273002	MSF 034.4224	2 A 125 V Plug-In
F11 F12 F21 F22 F31 F32	G50382-0011	273.250	MSF 034.4213	1/4 A 125 V Plug-In

Analog Card Cage Field Interface Cards:
Smart Transmitter Daughterboard Kit (EMC Compliant) 10P54500005
Analog FIC W/Smart Transmitter Daughterboard 1984-2519-000x
Analog FIC W/Smart Transmitter Daughterboard (EMC) 10P57240002
Smart Transmitter Daughterboard Kit 1984-2483-0005

Smart Transmitter Daughterboard LEDs

LEDs	Meaning
RTS Request to Send	The Smart daughterboard generated a request to send. The card is transmitting to a Smart device.
XMIT/RECV	Shows data transmission in either direction. Flickering indicates data flow.
Input Select 3	Daughterboard is communicating with the third FIC I/O point.
Input Select 2	Daughterboard is communicating with the second FIC I/O point.
Input Select 1	Daughterboard is communicating with the first FIC I/O point.

Analog Card Cage Field Interface Cards:
Pulse I/O FIC (EMC Compliant) 10P54470002
Pulse I/O FIC 1984-2456-000x

Pulse I/O FIC Input Specifications

Term	Voltage Input Specification	Contact Input Specification
Input Frequency	Sine Wave 1 Hz - 50K Hz Square Wave .002 Hz - 50K Hz	.002 Hz - 50K Hz
Input Accuracy	0.05% of reading	0.05% of reading
Resolution	0.01% of reading	0.01% of reading
Count Match Response Time	5 ms maximum	5 ms maximum
Minimum Pulse Width	10 μs	10 μs
Voltage Range	50 mV to 30 V peak-to-peak	-
ON State Current	-	9 mA minimum
OFF State Current	-	5 mA maximum
Short Circuit Current	-	20 mA nominal
Open Circuit Voltage	-	21 V minimum, 24 V maximum
Impedance	100 K ohms minimum 300 pF maximum	-
Temperature Effect	0.01% within 0° to 50° C	0.01% within 0° to 50° C
Common Mode Rejection	80DB 47-52, 57-63 Hz, at 3 V peak-to-peak	-
Normal Mode Protection	Fuse and transient suppressors	-
Isolation	point-to-point	point-to-point

Pulse I/O FIC Output Specifications

Term	Pulse Output Specification	Analog Output Specification
Output Range	0 to 1K Hz	0–60 mA
Output Accuracy	–	0.5% of 4–20 mA span below 20 mA, 0.4% of reading above 20 mA
OFF State Leakage Current	20 μA maximum	20 μA maximum
Output Current Limit	20 +/–0.5 mA	60 mA min 65 mA max
Source Resistance	100 ohms maximum	25 ohms maximum (supply mode)
Open Loop Voltage	21–24 V	21.5 V to 24.5 V
Output Resolution	–	11 bits 4–20 mA range on 7.5 μA
Output Fail Options	None	Off only
Timing Accuracy	+/– [20 μs + 0.01% of interval]	–
Timing Resolution	1 μsec	–
Minimum Pulse Width	0.5 msec	–
Maximum Frequency	1K Hz with one output point	–
Temperature Effect	0.01%, within 0° to 50° C on timing	0.1% of 4–20 mA span, within 0° to 50° C on output current
Isolation	point-to-point	point-to-point

Pulse I/O FIC LEDs

LEDs	Meaning
DS1	Card Good: No card faults are detected and the Controller Processor card is controlling the output current. Blinking LED indicates the FIC is not connected to the field (I/O).
DS2	Card Fault: A card fault is detected or communications with the Controller Processor card have ceased.
DS3	TX Enable: Indicates communications activity. The signal that enables the transmit signal from the Field Interface card to the Controller Processor card is active.
DS4	30V Fuse Blown: Power fuse F1 has blown. This LED does not indicate the status of the fuses in the I/O loops.
DS5	Status 1: Represents the state of INPUT 1. (Note: the state is shown after the prescaler.)
DS6	Status 2: Represents the state of INPUT 2. (Note: The state is shown after the prescaler.)
	Not Used: For future use.

Pulse I/O FIC Card Jumper Positions

Jumper	1:7, 1:3, or No Redundancy	1:1 Redundancy
HD4A HD4B HD4C	1-2	2-3

Pulse I/O Field Interface Card Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0021	273002	MSF 034.4224	2.0 A 125 V Plug-In
F11 F12 F21 F22 F31 F32	G50382-0011	273.250	MSF 034.4213	1/4 A 125 V Plug-In

Analog Card Cage Field Interface Cards: Temperature Input FIC 1984-2731-000x

Temperature Input FIC Specifications

Term	Specification
Temperature Drift	±.125%Full Scale/25 °C change from calibration temperature
Cold Junction Compensation	RTD 57.72 ohms nickel sensor value broadcast through Controller Processor
Cold Junction Temperature Range	-30 C to +70 °C
Accuracy Cold Junction Compensation Circuit	±.55 °C
Input Isolation	point-to-point
Maximum Sensor Wiring Resistance	500 ohms per line
RFI Immunity	.2% to .6% Full Scale
External Resistance	3.21 to 390 ohms
Ambient Cabinet Temperature	0-50 °C
Input Power	16-36 VDC
Power Requirements	35 V 100 mA, nominal 30 V 112 mA, nominal 24 V 140 mA, nominal 20 V 164 mA, nominal
Turn On Voltage	20 V, nominal
Turn Off Voltage	15 V, nominal
RTD Excitation Current	229 µA, nominal
RTD Resistance Range	Range 1: 0-100 ohms Range 2: 0-400 ohms
Millivolt Input Range	Gain 1: -4 to 22 mV Gain 2: -16 to 88 mV

(continued on next page)

Temperature Input FIC Specifications (continued)

Term	Specification
Accuracy (at calibration temperature)	TC/mv, Range 1: ±0.075% (19.5 μV) TC/mv, Range 2: ±0.048% (50 μV) RTD/Ω, Range 1: ±150 Milliohms RTDΩ/, Range 2: ±200 Milliohms
Input Impedance for Thermocouples	>100 Megohm

Temperature Input FIC LEDs

LEDs	Meaning
DS1	Card Good: No card faults are detected.
DS2	Card Fault: A card fault is detected or communications with the Controller Processor card have ceased.
DS3	TX Enable: Indicates communications activity. The signal that enables the transmit signal from the Field Interface Card to the Controller Processor is active.
DS4	30V Fuse Blown: Power Fuse F1 has blown.

Temperature Input FIC Card Jumper Positions

Jumper	1:7, 1:3, or No Redundancy	1:1 Redundancy
HD2 HD3 HD4	1-2	2-3

Temperature Input Field Interface Card Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0021	273002	MSF 034.4224	2.0 A 125 V Plug-In
F6 to F11	G50382-0009	273.125	MSF 034.4210	1/8 A 125 V Plug-In

Contact Card Cage 1984-2576-0001
Contact FlexTerm 1984-1175-000x
..... 1984-1336-000x

Parts Replacement

Part No.	Replaces	Characteristics
1984-2576-0001	None	Used only with MPCx images
1984-1336-000x	1984-1175-000x	Used only with CC image.
1984-1175-000x	None	Used only with CC image. Has marshaling panel connectors

Contact Card Cage and Contact FlexTerm Jumper Positions

Jumper	Purpose	Position
HD1, HD2	Indicates whether redundant Controller Processor Cards are connected to the Contact Card Cage and the ControlFile.	NORMAL: No redundant Controller Processors REDUNDANT: Redundant Controller Processors (HD1 and HD2 must be jumpered in the same position.)
HD3A through HD3H	Indicates whether the Contact Card Cage is Card Cage A or Card Cage B. The eight sets of jumpers correspond to the eight contact FICs.	-Card Cage A- Indicates card cage A -Card Cage B- Indicates card cage B **NOTE:** HD3A through HD3H must be jumpered in the same position.

Contact Card Cage and Contact FlexTerm Fuses

FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
G09140-0032	MDL 2	313002	2 A 250 V Slow Blow

Contact Termination Board 1984-1288-0001

Analog Transfer Card Fuse Data

Fuse	FRSI Part No.	Bussman Part No.	Characteristics
F1 to F24	G09140-0029	MDQ 1-1/2	1.5 A 250 V Slow Blow **NOTE:** Other fuses may be used to match the applied load.

Contact Marshaling Panel 1984-2486-000x

Contact Marshaling Panel Specifications

Term	Specification
Current Ratings/Temperature	DC Output: 2.3 amps at 25° C 1.8 amps at 40° C 1.0 amps at 60° C AC Output: 3.0 amps at 25° C 2.3 amps at 40° C 1.2 amps at 60° C
Voltage	Maximum: 300 V rms
Fusing	4 amp slow blow per Optical Isolator Module
Cabling	50 conductor round cable
Maximum distance	Card Cage or FlexTerm to Marshaling Panel: 750 feet
Connection to Card Cage or FlexTerm	50 conductor cable terminated to connector on motherboard.
Wire gauge	14–22 AWG solid or stranded

Contact Marshaling Panel Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 to F24	G09140–0038	MDL 4	313004	4 A 250 V Slow Blow **NOTE:** Smaller fuses should be used if smaller loads are applied.

Optical Isolator Modules G12243-00xx

Optical Isolator Modules

Part Number C12243-	Model	Function	Output Contact*	Voltage	Color
0005	IAC5A	Input	None	180-280 VAC/DC	Yellow
0006	IDC5	Input	None	10-32 VDC	White
0007	IDC5B IDC5F	Input	None	4-16 VDC	White
0008	IAC5	Input	None	90-140 VAC/DC	Yellow
0009	ODC5	Output	N.O.	5-60 VDC	Red
0010	ODC5A	Output	N.O.	5-200 VDC	Red
0011	OAC5A5	Output	N.C.	24-280 VAC	Black
0012	OAC5	Output	N.O.	12-140 VAC	Black
0013	OAC5A	Output	N.O.	24-280 VAC	Black

* All output modules, except OAC5A5, have normally open (N.O.) outputs. The output contact is open when the block output is false.

Maximum Current Ratings for Modules Mounted on Marshaling Panels

Ambient Temperature	DC Output Modules	AC Output Modules
25 °C	2.3 Amps	3.0 Amps
40 °C	1.8 Amps	2.3 Amps
60 °C	1.0 Amp	1.2 Amps

Contact FIC 1984-1460-000x
. . . . . 1984-1304-000x

Contact FIC Specifications

Item	Specification
Power: Voltage Current	 22–34 VDC 90 mA at 30 V typical.
Switching current	10 mA typical, 8 mA minimum

Contact FIC LEDs

LEDs	Meaning
DS5–DS10	I/O 1–6: Indicates the logic state of the module's input or output. With a normally open input or output, the module is on if the LED is on. With a special order normally-closed output module, contact is made with no power applied. The LED is on with an open contact on the module.
DS3	30V Fuse Blown: Replace power fuse F1 on the Contact Field Interface Card.
DS4	TX Enable: The signal which enables the transmit signal from the Field Interface Card to the Contact Processor is active.
DS2	Card Fault: A Fault is detected on the contact Field Interface card, or communications with the contact processor have ceased. Discrete outputs will go to the condition called for by the position of jumper HD1 (hold or off).
DS1	Card Good: No faults are detected on the Contact Field Interface card and communication with the Contact Processor is active.

Contact FIC Jumper Positions

Jumper	Position	Effect
HD1	HOLD	Hold output value on communications failure
	OFF	Drive output to zero on communications failure

Contact FIC Fuses

Card 1984-1460-000x

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-001 4	- -	273.500	MSF 034.4216	1/2 A 125 V Plug-In

Card 1984-1304-000x

F1	G9140-0016	AGC 1/2	312.500	- -	1/2 A 250 V Quick Acting

MUX Marshaling Panels

Voltage **1984-2457-0002**
Current **1984-2458-0001**
RTD **1984-2456-0002**

Voltage MUX Marshaling Panel Specifications

Item	Specification
Voltage	CSA: 150 V rms With a locally coated connector: 250V rms
Wire gauge	12-20 AWG solid, stranded, lugged
Temperature	Maximum: 105° C
Connection to FlexTerm	50 conductor cable terminated to connector on FlexTerm motherboard.

4-20 mA MUX Marshaling Panel Specifications

Item	Specification
DC power isolation and fusing	1984-1321 fuse module with isolating diodes
Per point fusing	1/4 A
Temperature range	0-70° C
Maximum voltage	Transmitter powered: 250 V rms System and remote powered: 150 V rms
Wire gauges	12-20 AWG solid, stranded, lugged
Connection to FEM	50 conductor cable terminated directly to FEM terminals.

RTD MUX Marshaling Panel Specifications

Item	Specification
Voltage	CSA 150 V rms With a locally coated connector: 250V rms
Wire gauge	12–20 AWG solid, stranded, lugged
Temperature	Maximum: 105° C
Connection to FlexTerm	50 conductor cable terminated to connector on FlexTerm motherboard.

PLC FlexTerm 10P53200001
. 1984-2409-0001

NOTE: Use only 10P53200001 for EMC (CE) compliant installations.

PLC FlexTerm Jumpers

Jumper	No Redundancy	Redundancy
HD1A HD1B	1-2	2-3
HD2A HD2B	1-2	2-3

NOTE: If only communication lines are used, the FlexTerm redundancy jumpers are inactive.

Parts Replacement

Part No.	Replaces	Characteristics
10P53200001	1984-2409-0001	Replaces in all cases.
1984-2409-0001	10P53200001	Except in EMC compliant installations or ones using the communication lines.

Port I/O Card:
RS-422/RS-232 . . . . . 10P54880001
. 1984-2402-0001

NOTE: Use only 10P54880001 for EMC (CE) compliant installations

Parts Replacement for the RS-422/RS-232 Port I/O Card

Part No	Replaces	Comments
10P54880001	1984-2402-000x	Always permitted.
1984-2402-0001	10P54880001	Only for non-EMC approved installations.

RS-232C Pin Assignments

PLC Plug (15 Pin) (For Allen Bradley KE Module only)	Signal	Port I/O Card (25 Pin)	Signal
1	SHLD	1	SHLD
2	TXD	*2*	TXD
3	RXD	3	RXD
4	RTS	4	RTS
5	CTS	5	CTS
6	DSR	6	SR
7	GND	7	GND
8	DCD	8	DCD
11	DTR	11	GND
13	GND	20	DTR

Port I/O Card RS-422/RS-232 LEDs

LEDs	Meaning
DS4	Receive Data: Indicates that data is being received from the PLC device.
DS3	TX Data: Indicates that data is being sent to the PLC device.
DS2	30V Fuse Blown: Power fuse F1 is blown.
DS1	Card Good: Voltages are within tolerances.

RS-422/RS-232 Port I/O Card Jumper Positions

Jumper	Position	Effect
HD1A-D	A B	Use Communications Port A Use Communications Port B
HD2A-B	MOD TERM	Port I/O Card is a Modem Port I/O Card is a Terminal
HD3	S M	Single Point: One PLC MultiDrop: Several PLCs

RS-422/RS-232 Port I/O Card Fuse

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0014	273.500	MSF 034.4216	1/2 A 125 V Plug-In

Port I/O Card: RS-422/RS-422 ..... 10P54850001
..... 1984-2441-0001

NOTE: Use only 10P54850001 for EMC (CE) compliant installations.

Parts Replacement for the RS-422/RS-232 Port I/O Card

Part No	Replaces	Comments
10P54850001	1984-2441-000x	Always permitted.
1984-2441-000x	10P54850001	Only for non-EMC approved installations.

Port I/O Card RS-422/RS-422 LEDs

LEDs	Meaning
DS4	Receive Data: Indicates that data is being received from the PLC device.
DS3	TX Data: Indicates that data is being sent to the PLC device.
DS2	30V Fuse Blown: Power fuse F1 is blown.
DS1	Card Good: All voltages are within tolerances.

RS-422 Pin Assignments

Pin	Signal
1	To Cable Shield
3	Transmit Data -
9	Transmit Data +
4	Receive Data -
6	Receive Data +
5	Isolated Return

RS-422/RS-422 Port I/O Card Jumpers

Jumper	Port A	Port B
HD1A-D	A	B

RS-422/RS-422 Port I/O Card Fuse

Fuse	FRSI Part No.	Littelfuse Part No.	Schurter Part No.	Characteristics
F1	G50382-0021	273002	MSF 034.4224	2 A 125 V Plug-In

Analog Input FIC: Non-Isolated 1984-1463-0001
..... 1984-1394-000x

Non-Isolated Analog Input FIC LEDs

LEDs	Meaning
-	30V Fuse Blown: The 30 VDC power fuse to the card is blown. Note that this LED does not indicate whether field transmitter power and input current fuses are operational.
DS1	+12V Status: Power is present and the regulator is operational.

Non-Isolated Analog Input FIC Test Points

Test Points	Meaning
Brown	Ground return.
Yellow	1 to 5 V analog signal to controller.

Non-Isolated Analog Input FIC Jumper Positions

Jumper	Position	Purpose
HD1	1-2: System supplies power to transmitter output device. 2-3: Transmitter or output device supplies its own power.	Specifies FICs power setup.

Non-Isolated Analog Input FIC Fuses

Fuse	FRSI Part No.	Bussman Part No.	Littelfuse Part No.	Characteristics
F1 F2 F3	G09140-0010	AGC 1/4	312.250	1//4 A 250 V Quick Acting

Analog Input FIC: Smart Transmitter 1984-2412-0001

Smart Transmitter FIC LEDs+

LEDs	Meaning
DS4	Communications Activity: Indicates communications activity. The signal that enables the transmit signal from the Field Interface Card to the Controller Processor card is active.
DS3	Fuse F3 Blown: Power fuse F3 has blown. This LED does not indicate the status of the fuses in the I/O loops.
DS2	Card Bad: A card fault is detected or communications with the Controller Processor have ceased.
DS1	Card Good: Card has passed power-up diagnostics.

Smart Transmitter FIC Test Points

Test Point	Meaning
TP1 Controller	Controller loop current measured across 250 ohm resistor.
TP2 GND	Ground.

Smart Transmitter FIC Jumper Values

Jumper	Smart Transmitter Powered by System	Smart Transmitter Self Powered
HD1	1-2	2-3

Smart Transmitter FIC Fuses

Fuse	FRSI P/N	Littelfuse P/N	Schurter P/N	Characteristics
F1 F2	G50382-11	273.250	MSF 034.4213	1/4 A Plug-In
F3	G50382-14	273.500	MSF 034.4216	1/2 A Plug-In

Analog Input FIC: Isolated 1984-1325-0001

Isolated Analog Input FIC LEDs

LEDs	Meaning
DS4	Input Signal: Indicates that the field input is present. The LED glows brighter as the field input increases. With no input, the LED is off.
DS3	30V Fuse Blown: The 30 VDC power fuse to the card is blown. Note that this LED does not indicate whether field transmitter power and input current fuses are operational.
DS2	+12V Non-Isolated Status: The non-isolated +12 V regulator is operational.
DS1	+12V ISO Status: The isolated +12 V regulator is operational.

Isolated Analog Input FIC Test Points

Test Point	Meaning
Yellow	1 to 5 V analog signal to controller.
Brown	Ground return.

Isolated Analog Output FIC Jumper Positions

Jumper	Position	Purpose
HD1	1-2	System supplies power to transmitter or output device.
	2-3	Transmitter or output device supplies it own power.

Isolated Analog Output FIC Fuses

Fuse	FRSI P/N	Bussman P/N	Littelfuse P/N	Characteristics
F1 F2	G09140-0010	AGC 1/4	312.250	1/4 A 250 V Quick Acting
F3	G09140-0016	AGC 1/2	312.500	1/2 A 250 V Quick Acting

Analog Output FIC: Non-Isolated 1984-1490-0001
. 1984-1273-0001

Non-Isolated Analog Output FIC LEDs

LEDs	Meaning
DS4	TX Enable: The signal that enables the transmit signal from the Field Interface Card to the MultiLoop Processor is active.
DS3	30V Fuse Blown: One of three fuses has blown: F3 = digital section power regulator; F4 = analog panel station power; F5 = analog section power. This LED does not indicate the status of the two fuses on the output.
DS2	Card Fault: A card fault is detected, or communications with the MultiLoop Processor have stopped. If a communication problem occurs, the output current is held at its last value or goes to zero.
DS1	Card Good: No card faults are detected and the MultiLoop Processor or an analog panel station is controlling the output current.

Non-Isolated Analog Output FIC Test Points

Test Points	Meaning
Brown	Ground return.
Yellow	Main 5V regulator.

Non-Isolated Analog Output FIC Jumper Positions

Jumper	Purpose	Position
HD1	Indicates whether the FIC holds the last output value or sets the output current to zero if there is loss of communication with the Controller Processor card.	HOLD: The last output value is held if there is a failure within the ControlFile, with the comm lines, or at the FIC. If the power supply should fail, the output current goes to zero. OFF: The output value is held for about 1/2 second before going to zero if there is a failure in the FIC processors. For other types of failures, the output value is held for up to four seconds before the output current goes to zero.
HD2 1984-1490-000x only	Select normal or reversed output	1-2 Normal Output 2-3 Reversed Output

Non-Isolated Analog Output FIC Fuses

Fuse	FRSI P/N	Littelfuse P/N	Schurter P/N	Characteristics
F1 F2	G50382-0011	273.250	MSF 034.4213	1/4 A 125 V Plug-In
F3 F5	G50382-0014	273.500	MSF 034.4216	1/2 A 125 V Plug-In
F4	G50382-0021	273.002	MSF 034.4224	2 A 125 V Plug-In

Analog Output FIC: Isolated 1984-1525-000x
..... 1984-1469-0003
..... 1984-1334-000x

Isolated Analog Output FIC LEDs

LEDs	Meaning
DS4	TX Enable: The signal that enables the transmit signal from the Field Interface Card to the MultiLoop Processor is active.
DS3	30V Fuse Blown: One of three fuses has blown: F3 = digital section power regulator; F4 = analog panel station power; F5 = analog section power. This LED does not indicate the status of the two fuses on the output.
DS2	Card Fault: A card fault is detected, or communications with the MultiLoop processor have ceased. If a communication problem occurs, the output current is held at its last value or goes to zero.
DS1	Card Good: No card faults are detected and the MultiLoop Processor or an analog panel station is controlling the output current.

Isolated Analog Output FIC Test Points

Test Points	Meaning
Brown	Ground return.
Yellow	Main 5V regulator.

Isolated Analog Output FIC Jumper Positions

Card	Jumper	Purpose	Position
1984-1525-000x 1984-1469-000x	HD1A and HD1B	Indicates whether the FIC holds the last output value or sets the output current to zero if there is loss of communication with the Controller Processor card.	HOLD: The last output value is held if there is a failure within the ControlFile, with the comm lines, or at the FIC. If the power supply should fail, the output current goes to zero. OFF: The output value is held for about 1/2 second before going to zero if there is a failure in the FIC processors. For other types of failures, the output value is held for up to four seconds before the output current goes to zero.
	HD2	Select normal or reversed output	1-2 Normal Output 2-3 Reversed Output
1984-1334-000x	HD1 HD2	Indicates whether the FIC holds the last output value or sets the output current to zero if there is loss of communication with the Controller Processor card.	HOLD: The last output value is held if there is a failure within the ControlFile, with the comm lines, or at the FIC. If the power supply should fail, the output current goes to zero. OFF: The output value is held for about 1/2 second before going to zero if there is a failure in the FIC processors. For other types of failures, the output value is held for up to four seconds before the output current goes to zero.

Isolated Analog Output FIC Fuses

Fuse	FRSI P/N	Littelfuse P/N	Schurter P/N	Characteristics
F1 F2 F3 F4	G50382-0014	273.500	MSF 034.4216	1/2 A 125 V Plug-In

I/O Scanning Rates

NOTE: Addressing any panel or card cage as “B”, “C”, or “D” drops the scanning rate to the slowest rate shown even if there are no other addressed panels or cages. The controller scan time (1.0, .50, .25, .125 second), selected from the ControlFile Status screen, must always be greater than the I/O point scan time. The controller scan time applies to all card cages served by the controller, so the scan time of the slowest cage must be used.

Highest Card Cage Address	Cage Scan Pattern	Cage Scan Rate (Scans Per Second)	Minimum Controller Scan Time (Seconds)	
			MDIO	MAIO
A	AAAA	32	.125	.25
B	ABAB	16	.125	.50
C	ABAC	A: 16 B, C: 8	.25	1.0
D	ABCD	8	.25	1.0

Remote Communications Termination Panel II 1984-4205-0001
Remote Communications Termination Panel I 1984-2552-0001

Remote Communications Termination Panel Parts Replacement

Part No	Replaces	Characteristics
1984-4409-0001 (Kit)	1984-2552-000x	The Kit replaces a Remote Communications Termination Panel I. The kit contains two Remote Communications Termination Panel II units and a DIN rail for mounting them.

Remote Communications Termination Panel II Jumpers

Jumper	Position	Effect
HD1	REMOTE I/O (1-2)	Used when the panel is at the remote end of the communication line; at the card cage or FlexTerm.
	CONT FILE (2-3)	Used when the panel is at the ControlFile (source) end of the communication line.
HD4A HD4B	NORMAL (1-2)	Normal operation. One cable is used from the ControlFile to the panel. The panel is connected to one Controller Processor.
	REDUNDANT (2-3)	Redundant operation. Two cables are used between the ControlFile and the panel. The panel is connected to two Controller Processors.

Remote Communications Termination Panel I Jumpers

Jumper	Position	Effect
HD1A HD1B (Top panel)	NORMAL (1-2)	Normal operation. One cable is used from the ControlFile to the panel.
	REDUNDANT (2-3)	Redundant operation. Two cables are used between the ControlFile and the panel.
HD3 (Top panel)	REMOTE I/O (1-2)	Used when the panel is at the remote end of the communication line: at the card cage or FlexTerm.
	CONTROL FILE (2-3)	Used when the panel is at the ControlFile (source) end of the communication line.
HD2A HD2B (Lower panel)	NORMAL (1-2)	Normal operation. One cable is used from the ControlFile to the panel.
	REDUNDANT (2-3)	Redundant operation. Two cables are used between the ControlFile and the panel.
HD4 (Lower panel)	REMOTE I/O (1-2)	Used when the panel is at the remote end of the communication line: at the card cage or FlexTerm.
	CONTROL FILE (2-3)	Used when the panel is at the ControlFile (source) end of the communication line.

Fiber Optic I/O Converter 1984-3278-0001

NOTE: Use Minimum Revision C/D or higher for EMC (CE) compliant installations.

Fiber Optic I/O Converter LEDs

LED	Color	Function
5V POWER	GREEN	ON when power is ON.
RECEIVE DATA	YELLOW	Flashes when the unit is receiving data.
TRANSMIT DATA	YELLOW	Flashes when the unit is transmitting data.

Standard Remote Termination Panel 1984-4344-0001

Standard Remote Termination Panel, Marshaling Panel Cable

Application	Use Cable
Multi-FIM Termination Panel	1984-4299-xxxx
Multi-FIM Termination Panel, Redundant FIMs	1984-4319-xxxx
High Density Isolated Discrete Termination Panel	1984-4298-xxxx
High Density Isolated Discrete Termination Panel, NEC/CSA	1984-4345-xxxx

Direct Discrete Termination Panel 1984-4127-0001

NOTE: For most applications, FRSI recommends that VTH be ½Vsource. For an input point with VTH = ½Vsource, the resistance to Vsource of the field device in the ON state must be 1400 ohms or less to ensure positive turn-ON. The resistance to Vsource of the field device in the OFF state must be 3200 ohms or greater to ensure positive turn-OFF.

Parts Replacement for the Direct Discrete Termination Panel

Part No.	Replaces	Name on PWA	Characteristics
10P52700001	1984-4127-0001	DIRECT DISCRETE TERMINATION PANEL II	Use only the MDIOL Low-Side Switch FIM to ensure compatibility.
1984-4127-0001	10P52700001	DIRECT DISCRETE TERMINATION PNL	Valid replacement only in non-EMC installations that use the MDIOL Low-Side Switch FIM.

Direct Discrete Termination Panel Jumpers

Jumper	Value	Effect
HD1	A	FIM address A (factory setting)
	B	FIM address B
	C	FIM address C
	D	FIM address D
	E	Not used
	F	Factory setting, do not move
HD2	Both Jumpers ON or both jumpers at NORM or both wires intact	Normal single FIM operation with online replacement capability
	Both Jumpers OFF or both jumpers at FIM REDUND or both wires cut	Redundant FIM operation

Direct Discrete Termination Panel Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Wickman Part No.	Characteristics
F1 to F32	G53394-1000-0005	216 001	19 194 1 A	1 A 250 V (IEC) Quick action 5x20 mm Ceramic

Direct Discrete Termination Panel II 10P52700001

NOTE: For most applications, FRSI recommends that VTH be ½Vsource. For an input point with VTH = ½Vsource, the resistance to Vsource of the field device in the ON state must be 1400 ohms or less to ensure positive turn-ON. The resistance to Vsource of the field device in the OFF state must be 3200 ohms or greater to ensure positive turn-OFF.

Parts Replacement for the Direct Discrete Termination Panel

Part No.	Replaces	Name on PWA	Characteristics
10P52700001	1984-4127-0001	DIRECT DISCRETE TERMINATION PANEL II	Use only the MDIOL Low-Side Switch FIM to ensure compatibility.
1984-4127-0001	10P52700001	DIRECT DISCRETE TERMINATION PNL	Valid replacement only for non-EMC installations that use the MDIOL Low-Side Switch FIM.

Direct Discrete Termination Panel II Jumper Settings

Jumper	Setting	Function
HD1-HD16 (One jumper per point)	Left	MDIOL: Input or Output Point MDIOH: Input Point
	Right	MDIOH: Output Point
HD17 (One jumper)	A	Use Card Cage Address A
	B	Use Card Cage Address B
	C	Use Card Cage Address C
	D	Use Card Cage Address D
	E	Not used
	F	Not used

(continued on next page)

Direct Discrete Termination Panel II Jumper Settings

Jumper	Setting	Function
HD18	NORM	Normal single-FIM operation
(Two jumpers)	REDUN	Redundant operation with two FIMs

Direct Discrete Termination Panel II Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Wickman Part No.	Characteristics
F1 to F32	G53394-1 000-0005	216 001	19 194 1 A	1 A 250 V (IEC) Quick action 5x20 mm Ceramic

Multi-FIM Discrete Termination Panel 1984-4282-0001

Multi-FIM Discrete Termination Panel Jumpers

Jumper	Value	Effect
HD1, 2, 3	A ON	FIM address A (factory setting) **NOTE:** Only one jumper is allowed in positions A-D
	B ON	FIM address B
	C ON	FIM address C
	D ON	FIM address D
	E OFF	Not used
	F ON	Factory setting, do not move
HD4-8	1-2	Normal individual FIM operation
	2-3	Redundant operation of FIMs A and B
HD9, 10, 11	1-8 OFF 2-7 ON 3-6 ON 4-5 ON	Normal loop operation
	1-8 ON 2-7 OFF 3-6 OFF 4-5 OFF	Used with Intrinsically Safe barriers **CAUTION** Remove power from the panel before moving jumpers on HD9, 10, or 11. The FIM may be damaged if 1-8 is ON when any of the other positions are ON.
HD12	OFF (No jumpers)	Communication Ports A and B are independent (normal operation of FIMs A and B)
	1-12 ON 3-10 ON 5-6 ON	Communication Ports A and B are connected (for online replacement operation of FIMs A and B)

Isolated Discrete Termination Panel

A 1984-4121-0001
B 1984-4124-0001

NOTE: You must configure an I/O Block at FIM I/O address 1 to set the switch voltage for the entire FIM. Set to 1.7 volts for reliable operation.

WARNING

The solid state relays may be hot enough to cause burns.

Solid State Relays

Part Number C12243-	Model	Function	Output Contact*	Voltage	Color
0005	IAC5A	AC Input	None	180-280 VAC/DC**	Yellow
0006	IDC5	DC Input	None	10-32 VDC	White
0007	IDC5-B IDC5-F	DC Input	None	4-16 VDC	White
0008	IAC5	AC Input	None	90-140 VAC/DC**	Yellow
0009	ODC5	DC Output	N.O.	5-60 VDC	Red
0010	ODC5A	DC Output	N.O.	5-200 VDC**	Red
0011	OAC5A5	AC Output	N.C.	24-280 VAC**	Black
0012	OAC5	AC Output	N.O.	12-140 VAC**	Black
0013	OAC5-A OAC5-1	AC Output	N.O.	24-280 VAC**	Black
0014	IDC5G IDC5N	DC Input	None	35-60 VAC/DC	White
0015	ODC5RM ORR5-1	Dry Contact Relay	N.O.	100 VDC 130 VAC (Max switching current .5 A, 10 VA contact rating)**	

* All output modules, except OAC5A5, have normally open (N.O.) outputs. The output contact is open when the block output is FALSE.

**** CAUTION**

Hazardous voltages may be present on field wiring. Lock out and tag hazardous voltage circuits prior to servicing.

Isolated Discrete Termination Panel A Jumpers

Jumper	Value	Effect
HD1 (Panels “A” & “B”)	A	Card cage A (factory setting)
	B	Card cage B
	C	Card cage C
	D	Card cage D
	E	Not used
	F	Factory setting, do not move
HD2 (Panel “A” only)	Both Jumpers ON or both jumpers at NORM or both wires intact	Normal single FIM operation with online replacement capability
	Both Jumpers OFF or both jumpers at FIM REDUND or both wires cut	Redundant FIM operation

Isolated Discrete Termination Panel Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Wickman Series	Characteristics
F1 to F32	G53394-3150-0005	216 3.15	19 194 3.15 A	3.15 A 250 V (IEC) Quick action 5x20 mm Ceramic

CAUTION

Hazardous voltages may be present. Lock out and tag hazardous voltage circuits prior to servicing.

High Density Isolated Discrete Termination Panel . . . 1984-4167-0001

NOTE: You must configure an I/O Block at FIM I/O address 1 to set the switch voltage for the entire FIM. Set to 1.7 volts for reliable operation.

WARNING

The solid state relays may be hot enough to cause serious burns.

HIgh Density Isolated Discrete Termination Panel Address Jumpers

Position	Effect
A	Termination panel address is A (factory setting) (2-3 is ON)
B	Termination panel address is B
C	Termination panel address is C
D	Termination panel address is D
E	Not used
F	Factory setting, do not move

High Density Isolated Discrete Termination Panel Solid State Relays

Part Number C60350-	Model	Function	Output Contact	Voltage
0001	70M-IAC5-A	AC Input	None	180-280 VAC*
0002	70M-IDC5	DC Input	None	10-32 VDC
0003	70M-IAC5	AC Input	None	90-140 VAC*
0004	70M-ODC5	DC output	NO	5-60 VDC
0007	70M-OAC5-A	AC output	NO	24-280 VAC*

***CAUTION**

Hazardous voltages may be present. Lock out and tag hazardous voltage circuits prior to servicing.

Discrete Field Interface Module (FIM)
Multipoint Discrete I/O FIM
MDIOH (High-side switch, EMC approved) 10P53550006
MDIOL (Low-side switch, EMC approved) 10P53520006
MDIO (Low-side switch) 1984-4080-0001

Parts Replacement for the Discrete Field Interface Module

Part No.	Replaces	Name on Label	Characteristics
10P53550006	None	DISCRETE FIELD INTERFACE MODULE: HIGH SIDE SWITCH	High-side switching FIM (CE approved)
10P53520006	1984-4080-000x	DISCRETE FIELD INTERFACE MODULE: LOW SIDE SWITCH	Low-side switching FIM (CE approved). Use in any installation.
1984-4080-000x	10P53520006	DISCRETE FIELD INTERFACE MODULE	Low-side switching FIM Use only in non-CE approved installations.

Discrete FIM LEDs

LED	Meaning
On: FIM Good Flashing: FIM Inactive (Green)	ON steady when the FIM is in normal operation. Flashing when the FIM is disconnected from the field.
FIM Failure (Red)	ON when FIM considers itself failed or when the FIM is not communicating with the Controller.
Comm Active (Yellow)	Flashes when the FIM is communicating with the Controller Processor.
Input/Output Points 1-16 (Yellow)	Input: ON for voltage above threshold or for a closed contact OFF otherwise Output: ON when point is commanded ON OFF otherwise
Input-Only Points 17-32 (Yellow)	ON for voltage above threshold or for a closed contact OFF otherwise

MAIO16 Termination Panel
(Field wires land on panel) 10P54770001
(Field wires on panel or on marshaling panel) 10P54770002

MAIO16 is EMC compliant.

NOTE: All input points must be constrained to operate within the common mode range of +29 to –2 VDC. This is automatic when all inputs are system powered. The ground levels must remain within ± 2 Volts of each other or erroneous results will be reported. The ground reference is available on TB17.

Parts Replacement for the MAIO16 Termination Panel

Part No.	Replaces	Characteristics
10P54770001	1984-4383-0001	Replaces all cases.
	10P54770002 1984-4383-0002	Only if marshaling cable is not used.
10P54770002	10P54770001 1984-4383-0001 1984-4383-0002	Replaces all cases.

MAIO16 Termination Panel Jumpers

Jumper	Value	Effect
HD1-HD16	Full left	Self-Powered Input Point with external ground reference or Output Point
	Centered	System-Powered Input Point
	Full right	Self-Powered Input Point with ground reference at the Termination Panel
HD17	A at 1-2	Cage address A (Factory setting)
	B at 1-2	Cage address B
	C at 1-2	Cage address C
	D at 1-2	Cage address D

MAIO16 Termination Panel Jumpers

Jumper	Value	Effect
HD18 HD19	Both at “N” (1–2)	Normal single FIM operation
	Both at “R” (2–3)	Redundant FIM operation (Requires two FIMs and two communication lines)
TB17 TB18	V–, SH and CH jumpered (4-tab jumper installed)	Loop power negative and field wiring shields connected to chassis ground. Use with LPMs. (New factory setting.)
	SH to CH jumpered (4-tab jumper straddling TB18 or 2 tab jumper installed)	Field wire shields connected to chassis ground. Use with locally grounded source of loop power. (Old factory setting with 2 tab jumper.)
TB17 TB18	SH to CH open (Jumper removed)	Allows connecting shield to a different ground reference than chassis.
TB19 TB20 TB21 TB22	Jumpers fully installed, absent, or in “holder for loop position”.	Fully installed: Power at TBA used for loop power. Holder position: Loop power connected at TB17 Absent: LPMs used for loop power

MAIO Termination Panel
(Field wires land on panel) 1984-4383-0001
(Field wires on panel or on marshaling panel) 1984-4383-0002

NOTE: All input points must be constrained to operate within the common mode range of +29 to -2 VDC. This is automatic when all inputs are system powered. The ground levels must remain within ± 2 Volts of each other or erroneous results will be reported. The ground reference is available on TB17.

Parts Replacement for the MAIO Termination Panel

Part No.	Replaces	Characteristics
1984-4383-0001	1984-4383-0002	Only if marshaling cable is not used.
1984-4383-0002	1984-4383-0001	Replaces all cases.

MAIO Termination Panel Jumpers

Jumper	Value	Effect
HD1-HD16	Full left	Self-Powered Input Point with external ground reference or Output Point
	Centered	System-Powered Input Point
	Full right	Self-Powered Input Point with ground reference at Termination Panel
HD17	A at 1-2	Cage address A (Factory setting)
	B at 1-2	Cage address B
	C at 1-2	Cage address C
	D at 1-2	Cage address D
HD18 HD19	Both at "N" (1-2)	Normal single FIM operation
	Both at "R" (2-3)	Redundant FIM operation Requires two FIMs and two communication lines

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MAIO Termination Panel Jumpers

Jumper	Value	Effect
TB18	V-, SH & CH jumpered (4 tab jumper installed)	Loop power negative and field wiring shields connected to chassis ground. Use with LPMs. (New factory setting.)
	SH to CH jumpered (4 tab jumper straddling TB18 or 2 tab jumper installed)	Field wire shields connected to chassis ground. Use with locally grounded source of loop power. (Old factory setting with 2 tab jumper.)
	SH to CH open (Jumper removed)	Allows connecting shield to a different ground reference than chassis.
TB19 TB20 TB21 TB22	Jumpers fully installed, absent, or in ”holder for loop position”.	Fully installed: Power at TBA used for loop power Holder position: Loop power connected at TB17 Absent: LPMs used for loop power

MAI32 Termination Panel
(Field wires land on panel) 10P53490001
(Field wires on panel or on marshaling panel) 10P53490002

The panel supports 32 analog input points using two termination panel addresses and two input blocks. The first address supports the Left Group of points (L1–L16), the second address supports the Right Group of points (R1–R16). An Analog Input Block (AIB) or a Smart Transmitter Input Block (SIB) must be configured for each address. HART variables can be addressed by configuring a VIB.

The Field I/O Status Screen (previously the FIC Status Screen) shows the type of device connected to each controller. The MAI32 FIM will have two entries, one for each cage address used. The type code is “MAI32-x” where the “x” shows the card cage of the OTHER set of 16 points. Thus if the panel is addressed as A and C, the first entry will show “MAI32-C” and the second will show “MAI32-A”.

Multipoint Analog I/O Termination Panel Parts Replacement

Part No	Replaces	Comments
10P53490001	10P53490002	Only if marshaling cable is not used.
10P53490002	10P53490001	Valid for all cases.

MAI32 Termination Panel Jumpers

Jumper	Position	Effect
HDL01–HDL16 HDR01–HDR16	Full left	System-powered input point
Point Type	Full right	Self-powered input point
HD33	One jumper A–C at 1–2	Cage address for Left Group of points L01–L16 (A is recommended)
ADDRESS	One jumper B–D at 1–2	Cage address for Right Group of points R01–R16 (B is recommended)
	P at 1–2	Required for correct parity

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MAI32 Termination Panel Jumpers (continued)

Jumper	Position	Effect
HD34 LOOP PWR DETECT	ENABLE	Enables detection of loop power loss
	DISABLE	Disables detection of loop power loss
TB21 Shield Grounding	SH and CH connected	All field wiring shields are connected to panel chassis ground
	SH and CH open	All field wiring shields are connected together and are floating with respect to panel chassis ground
	SH connected to external ground	All field wiring shields are connected together and are connected to the external ground point

MAI32 Termination Panel Fuses

Fuse	FRSI Part No.	Littelfuse Part No.	Wickman Part No.	Characteristics
F1 to F32	G53394-0080-0005	Series 216	Series 19194	0.08 A 250 V (IEC) Quick acting

Loop Power Module (LPM) 1984-4398-0001
10P57070001

NOTE: The LPM produces up to 380 mA DC at 25.0 to 25.5 Volts.

Loop Power Module LEDs

LED	Meaning
GOOD (Green)	LPM functioning normally.
BAD (Red)	LPM out of specification or failed.
None Lit	LPM out of specification, failed, or no input power.

MAIO Input FIM
MAI16 (EMC Approved) ..... 10P54040004 or 10P57700005
MAIO 1984-4414-1001

MAIO FIM Parts Replacement

Part No	Replaces	Comments
10P54040004	1984-4414-0001 1984-4414-100x	All cases.
1984-4414-100x	1984-4414-0001	All cases.

MAIO FIM LEDs

LED	Meaning
On: FIM Good Flashing: FIM Inactive (Green)	ON steady when the FIM is in normal operation. Flashing when the FIM is disconnected from the field.
FIM Failure (Red)	ON when FIM considers itself failed. Flashing when the FIM is not communicating with the Controller.
Port A Active (Yellow)	Flashes when communication Port A is active.
Port B Active (Yellow)	For factory use only.
Status 1 (Yellow)	Flashes steadily while the FIM operates.
Status 2 (Yellow)	Flashes a diagnostic code if the FIM is disabled and the red LED is ON.

MAIO Input “Status 2” LED Diagnostic Codes

LED Code	Meaning
1	RAM failure.
2	Voltage failure, one or more internal voltages are out of tolerance.
3	Not assigned.
4	ADC failure.
5	Address jumpers on the Termination Panel are not set to A, B, C, or D.
6	Write or erase failure in FLASH.
7	Verification failure in BOOT or APP code.
8	Not assigned.
9	Not assigned.
10	Point diagnostic failure.
11	Not assigned.

MAIO Output FIM
MAO16 (EMC Approved) 10P54080004
MAO 1984-4418-0001

MAIO FIM Parts Replacement

Part No	Replaces	Comments
10P54080004	1984-4418-000x	All cases.

MAIO Output FIM LEDs

LED	Meaning
On: FIM Good Flashing: FIM Inactive (Green)	ON steady when the FIM is in normal operation. Flashing when the FIM is disconnected from the field.
FIM Failure (Red)	ON when FIM considers itself failed. Flashing when the FIM is not communicating with the Controller.
Port A Active (Yellow)	Flashes when communication Port A is active.
Port B Active (Yellow)	For factory use only.
Status 1 (Yellow)	Flashes steadily while the FIM operates.
Status 2 (Yellow)	Flashes a diagnostic code when the red LED is disabled and the red LED is ON.

MAIO Output FIM "Status 2" LED Codes

LED Code	Meaning
1	RAM failure.
2	Voltage failure, one or more internal voltages are out of tolerance.
3	Not assigned.
4	ADC failure.
5	Address jumpers on the Termination Panel are not set to A, B, C, or D.
6	Write or erase failure in FLASH.
7	Verification failure in BOOT or APP code.
8	Not assigned.
9	Not assigned.
10	Point diagnostic failure.
11	Not assigned.

MAI32 Input FIM (EMC Approved) 10P53190004

The FIM supports 32 analog input points using two termination panel addresses and two input blocks. The first address supports the Left Group of points (L1–L16), the second address supports the Right Group of points (R1–R16). An Analog Input Block (AIB) or a Smart Transmitter Input Block (SIB) must be configured for each address. HART variables can be addressed by configuring a VIB.

The Field I/O Status Screen (previously the FIC Status Screen) shows the type of device connected to each controller. The MAI32 FIM will have two entries, one for each cage address used. The type code is “MAI32-x” where the “x” shows the card cage of the OTHER set of 16 points. Thus if the panel is addressed as A and C, the first entry will show “MAI32-C” and the second will show “MAI32-A”.

MAI32 Input FIM LEDs

LED	Meaning
On: FIM Good Flashing: FIM Inactive (Green)	ON steady when the FIM is in normal operation. Flashing when the FIM is disconnected from the field.
FIM Failure (Red)	ON when FIM considers itself failed. Flashing when FIM is not communicating with the Controller.
Port A Active (Yellow)	Flashes when communication Port A is active.
Port B Active (Yellow)	For factory use only.
Status 1 (Yellow)	Flashes steadily while the FIM operates.
Status 2 (Yellow)	Flashes a diagnostic code when the FIM is disabled and the red LED is ON.

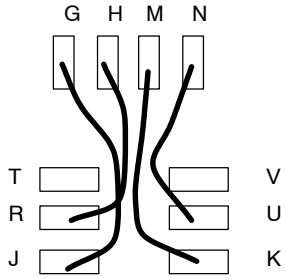
MAI32 FIM "Status 2" LED Patterns

LED Code Number	Meaning
1	RAM failure.
2	Voltage failure, one or more internal voltages are out of tolerance.
3	Point failure.
4	ADC failure.
5	Address jumpers on the Termination Panel are not set to A, B, C, or D.
6	Write or erase failure in FLASH.
7	Verification failure in BOOT or APP code.
8	Not assigned.
9	Not assigned.
10	Point diagnostic failure.
11	Temperature failure.

Elcon Series 1000 Intrinsically Safe Termination Panel
. . . . . 1216/CW-ROS4

NOTE: Elcon barriers require a DC source between 21.5 and 28 Volts. The standard RS3 power bus can exceed these limits, so the panel should not be powered directly from the standard DC bus. A Remote I/O Power Supply (1984-4302-0000x) can be used.

Elcon Panel Cross Wiring for Discrete Applications



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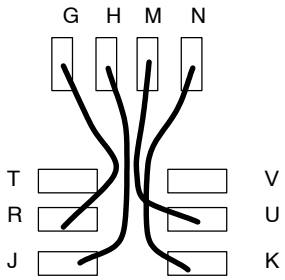
Elcon Discrete IS Barriers

Model	Elcon P/N	Description	Configuration	Comment
1822	1822 C0 0030 CC	Contact/Proximitor Input, Relay Output	2	Input
1842	1842 C0 0030 CC	Contact/Proximitor Input, Optocoupler Output	2	Input
1862	1862 L0 0060 CC	Contact Actuator	12	Output
1872	1872 L0 0060 WW	Solenoid Valve Driver (35 mA per channel)	6	Output
1882	1882 L0 0060 UU	Solenoid Valve Driver (70 mA per channel) Solenoid Valve Normally Energized	2	Output
1882	1882 L0 0060 WW	Solenoid Valve Driver (70 mA per channel) Solenoid Valve Normally Deenergized	2	Output

Elcon Panel Cross Wiring for Analog Applications



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Elcon Analog IS Barriers

Model	Elcon P/N	Description	Configura-tion	Comment
1012	1012 V0 0444 AA	Volt/mA Converter	7	Input
1022	1022 A0 0242 AA	Smart Transmitter Barrier (Low Frequency Protocols)	6	Input
1026	1026 A0 0242 AA	Smart (High Frequency Protocols) or Non-Smart Transmitter Barrier	6	Input
1032	1032 H0 0242 AA	Bus Powered Analog Output Barrier	6	Output
1034	1034 H0 0242 AA	Loop Powered Analog Output Barrier	6	Output
1072	1072 D3 0510 AA	RTD/tx Potential Converter	7	Output
1072	1072 F3 0510 AA	RTD/tx Potential Converter	7	Output

Elcon IS Panel Fuses

Panel	Wickman P/N	Characteristics
Input	19 194 1.60 A	1.6 Amp 5x20 mm Ceramic 250 V IEC
Output	19 194 3.15 A	3.15 Amp 5x20 mm Ceramic 250 V IEC

MTL IS Termination Panel A 10P50370001

NOTE: The MTL discrete isolators can be operated from the standard RS3 DC bus but you must be aware that the isolators will stop operating at low voltage before the system stops.

Mapping of I/O Points to MTL Discrete Panel A Isolators

Input Point	Output Point	Isolator Position	Comment
1-2	1	1	
3-4	3	2	
5-6	5	3	
7-8	7	4	
9-10	9	5	
11-12	11	6	
13-14	13	7	
15-16	15	8	
17-18		9	
19-20		10	
21-22		11	
23-24		12	
25-26		13	
27-28		14	
29-30		15	
31-32		16	The common LFD signal is on input point 32. Do not put an isolator in position 16 if common LFD is used.

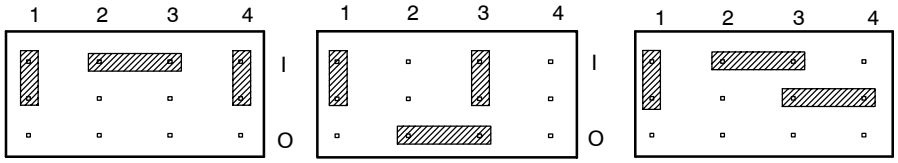
MTL Discrete IS Isolators

MTL P/N	Name	Comment
MTL4016	Two-Channel Switch/Proximity Detector Interface, With Line Fault Detection	Single-channel input – Serves an odd-numbered point on Panel A with the LFD signal on the even-numbered point.
MTL4021	Solenoid/Alarm Driver	Single-channel output – Serves an odd-number point on Panel A or an even-number point on Panel B.
MTL4023	Solenoid/Alarm Driver, With Line Fault Detection	Single-channel output – Serves an odd-numbered point on Panel A or an even-numbered point on Panel B (Common LFD is available).
MTL4025	Solenoid/Alarm Driver, Low Current Output	Single-channel output – Serves an odd-number point on Panel A or an even-number point on Panel B.

MTL Discrete Panel A Jumpers

Jumper	Value	Action
HD1–HD16	See diagrams below	Selects use of input/output, no LFD, common LFD, or individual LFD for the associated isolator 1–16.
HD17	A, B, C, **OR** D at 1–2 F MUST be at 1–2	Sets panel FIM address to A, B, C, or D. Jumper F sets standard transmission speed.
HD18	ENABLE	Enables common LFD for panels A and B.
	DISABLE	Disables common LFD for panels A and B.
HD20–HD21	Both at “N”	Normal single FIM operation.
	Both at “R”	Redundant FIM operation.

HD1 TO HD16 JUMPER SETTINGS

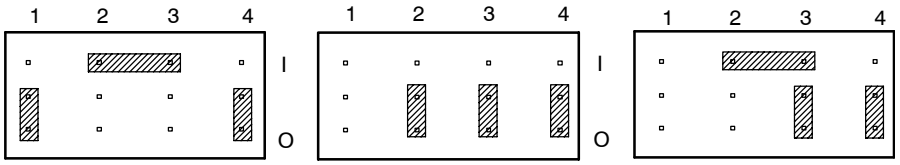


INPUT(S) WITH COMMON LFD, ALSO ENABLE HD18

INPUT(S) WITH INDIVIDUAL LFD

INPUT(S) WITH NO LFD

HD1 TO HD8 JUMPER SETTINGS FOR OUTPUT(S)



OUTPUT(S) WITH COMMON LFD, ALSO ENABLE HD18

OUTPUT(S) WITH INDIVIDUAL LFD

OUTPUT(S) WITH NO LFD

MTL Discrete Panel A Fuse

FRSI P/N	Wickman P/N	Littelfuse P/N	Characteristics
G53394-3150-0005	19 194 3.15 A	216 3.15	3.15 Amp 5x20 mm Ceramic 250 V IEC

MTL IS Termination Panel B 10P5049000x

NOTE: The MTL discrete isolators can be operated from the standard RS3 DC bus but you must be aware that the isolators will stop operating at low voltage before the system stops.

Mapping of I/O Points to MTL Discrete Panel B Isolators

Input Point	Output Point	Isolator Position	Comment
	2	17	
	4	18	
	6	19	
	8	20	
	10	21	
	12	22	
	14	23	
	16	24	
		25	Not Used
		26	Not Used
		27	Not Used
		28	Not Used
		29	Not Used
		30	Not Used
		31	Not Used
		32	Not Used

MTL Discrete Panel B Jumpers

Jumper	Value	Action
HD1	A, B, C, **or** D at 1-2 F MUST be at 1-2	Sets panel FIM address to A, B, C, or D. Jumper F sets standard transmission speed. Must be identical to the Panel A setting.
HD17-HD32	DISABLE	Default setting. Disables common LFD for the associated isolator 17-32.
	ENABLE	Enables common LFD for the associated isolator 17-32. Jumper HD18 on Panel A must be set to “ENABLE:.

MTL Discrete Panel B Fuse

FRSI P/N	Wickman P/N	Littelfuse P/N	Characteristics
G53394-3150-0005	19 194 3.15 A	216 3.15	3.15 Amp 5x20 mm Ceramic 250 V IEC

MTL IS Analog Termination 10P50340001

The MTL analog IS isolators that work with RS3 are listed below. See the MTL catalog for details.

MTL Analog Input and Output Isolators

MTL P/N	Description	Comment
MTL4041B	Repeater Power supply, 4/20 mA, for 2- or 3-wire Transmitters (Smart Devices)	Single-channel input – Works with 2- or 3-wire 4/20 mA transmitters (Smart Devices)
MTL4041P	High-power Repeater Power supply, 4/20 mA, for 2- or 3-wire Transmitters	Single-channel input – Works with 2- or 3-wire 4/20 mA transmitters and smart transmitters
MTL4045B	Isolating Driver, 4/20 mA, for I/P Converters	Single-channel output – Works with 4/20 mA current/pressure (I/P) converters
MTL4046P	High-power Isolating Driver, for HART Valve Positioners	Single-channel output – Works with 4/20 mA devices and HART valve positioners.

MTL Analog Termination Panel Jumpers

Jumper	Value	Action
HD3	A, B, C, **OR** D at 1–2	Sets panel FIM address to A, B, C, or D.
HD1–HD2	Both at “N”	Normal single FIM operation.
	Both at “R”	Redundant FIM operation.

MTL Analog Fuse

FRSI P/N	Wickman P/N	Littelfuse P/N	Characteristics
G53394–3150–0005	19 194 3.15 A	216 3.15	3.15 Amp 5x20 mm Glass 250 V IEC

Section 8:
PeerWay Interface

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Supervisory Computer Interface (SCI)

NOTE: The SCI can be connected to a host computer by:
RS-232
RS-422
RS-422 X.25

RS-232C Signals and Connector Pin Assignments

Pin	Signal	Pin	Signal
1	— —	14	— —
2	TXD Data transmit	15	— —
3	RXD Data receive	16	— —
4	RTS Ready to send	17	— —
5	CTS Clear to send	18	— —
6	DSR Data set ready	19	— —
7	Signal ground	20	DTR Data terminal ready
8	DCD Data carrier detect	21	— —
9	— —	22	— —
10	— —	23	— —
11	— —	24	— —
12	— —	25	— —
13	— —		— —

RS-422 Pins and Signals

Pin	Signal	Pin	Signal
1	— —	9	— —
2	— —	10	TXC+ (X.25 only)
3	CTS+ Clear to send	11	TXC– (X.25 only)
4	CTS– Clear to send	12	RXC+ (X.25 only)
5	RXD+ Data receive	13	RXC– (X.25 only)
6	RXD– Data receive	14	RTS+ Ready to send
7	TXD+ Data transmit	15	RTS– Ready to send
8	TXD– Data transmit		

X.25 Clocking Parameters

SCI Electrical Configuration	Nonvolatile Memory Jumper Configuration	Source of Clock Signals	Direction of Clock Lines (TXC and RXC)
Modem	Internal Clock	SCI	Output
Terminal	External Clock	Modem	Input

EIA Options

EIA Option	Description
CTS	SCI configured as a modem: When DTR (pin 20) is asserted by the host, the SCI can transmit. SCI configured as a terminal: When DCD (pin 8) is asserted by the host, the SCI can transmit.
MODEM	SCI configured as a terminal: The SCI monitors the modem Carrier Detect (CD) signal to determine when the host has called in. When DTR (pin 20) is asserted by the SCI, the modem answers the phone and establishes the carrier. When DTR is dropped by the SCI, the modem hangs up the line. Unless dropped to hang up the line, this pin remains asserted once software initialization is complete. DCD (pin 8) is asserted by the modem to inform the SCI that the data carrier is detected.
NONE	No EIA option is selected.

Highway Interface Adapter (HIA)

NOTE: Settings on the Configure HIA screen must match jumper settings on the HIA cards. When modems are used, a Black Box® Data Converter is required on each end of the line.

HIA/Black Box Cable Assembly Pin Assignments

Twisted Pair	Signal	Wire Color	RS-422 Connector (HIA)	RS-449 Connector (Black Box)
1	RXD – RXD +	Black Red	6 5	6 24
2	RTS – RTS +	Black White	15 14	7 25
3	TXC – TXC +	Black Green	11 10	5 23
4	RXC – RXC +	Black Blue	13 12	8 26
5	TXD – TXD +	Black Yellow	8 7	4 22
6	CTS – CTS +	Black Brown	4 3	9 27
1-6	Ground	Drain Wires	2	19, 20, 37
	Jumper Wire ($0.25\ mm^2$ 24 AWG)	White		7 TO 12
	Jumper Wire ($0.25\ mm^2$ 24 AWG)	White		25 TO 30

HIA Status Screen Field Definitions

Item	Definition
NRoute	Point-to-point messages routed across this HIA.
RCount	Messages received directly from the partner HIA.
XCount	Messages transmitted.
ICount	Level 3 direct communication interrupts.
RTic	TIC messages received directly from the partner HIA.
RDist	Distance information messages received.
RNode	Node/type information messages received.
RPoint	Point-to-point messages received.
RAck	ACK direct messages received (piggybacked on HIA partner message)
RStat	Partner HIA direct communication status messages received.
MaxHop	Messages discarded for taking more than the maximum number of hops.
DupRout	Duplicate route messages (a message ID with the same, or higher, content has been seen)
NoPath	Messages where this HIA does not know the current path to the destination node.
ReQueue	Messages requeued for transmission on another path.
CRC	Messages with bad Cyclical Redundancy Check received from partner HIA.
Abort	Direct messages aborted.
Size	Number of messages received with size errors.
BCount	Number of messages received with byte count errors.
Overrun	Number of messages received with overrun errors. (scaled x1) Number of messages received with gross transmit communications timeouts. (scaled x200) 403 means 2 transmit timeouts and 3 overrun errors.
XToss	Transmit messages toss for debugging.

(continued on next page)

HIA Status Screen Field Definitions (continued)

Item	Definition
RToss	Received messages toss for debugging.
TimeOut	Transmit queue timeouts.
TicLost	TIC messages lost (unacknowledged).
LnkLost	LINK messages lost (unacknowledged).
RNack	Not acknowledged responses received from the partner HIA.
RBusy	Buffer busy responses received.
REnq	Status enquiries received from partner HIA.
BadSeq	Bad message sequence number ID for messages between HIAs.
XBusy	Busy responses sent to partner HIA (HIA direct buffers busy).
XEnq	Status enquiries sent to partner HIA.

MicroVAX-PeerWay Marshaling Panel
(MicroVAX II) 1984-2533-0001
(MicroVAX 3000) 1984-2622-0001

MicroVAX/PeerWay Interface Marshaling Panel LEDs

LED	Description
B1 (RED)	Indicates the condition of the CPU card. (Board 1)
B2 (RED)	Indicates the condition of the PeerWay Interface card. (Board 2)
TXA (YELLOW)	Indicates transmission of data to PeerWay A. Blinks when data is sent.
TXB (YELLOW)	Indicates transmission of data to PeerWay B. Blinks when data is sent.
RXA (YELLOW)	Indicates data received from PeerWay A. Blinks when data is received.
RXB (YELLOW)	Indicates data received from PeerWay B. Blinks when data is received.

VAX QBUS Interface Circuit Cards:

QBUS Board 1 1984-3261-0002
. . . . . 1984-2507-000x
QBUS Board 2 1984-2510-0001

MicroVAX/PeerWay Interface Circuit Card Requirements

Item	Board 1 (CPU Card) 1984-3261-0002 1984-2507-000x	Board 2 (PeerWay Interface Card) 1984-2510-0001
5 VDC current	4 A	1.5 A
12 VDC current	— — —	700 mA
Total Watts	20 W	15.9 W
AC bus loads	1 AC load	0 AC load
DC bus loads	1 DC load	0 DC load

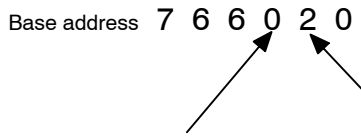
Board 1 Jumper Settings

Jumper	Setting	Function
HD1	2-3 (1984-2507-000x board only)	Factory setting, do not move.
HD2	2-3	Factory setting, do not move.
HD4-HD8	See text for data	I/O Space Code, determines the base address used.
HD13-HD18	See text for data	Memory Identification, first or second memory window.
HD29-HD30		Not used.

Jumper position to use the first memory window.

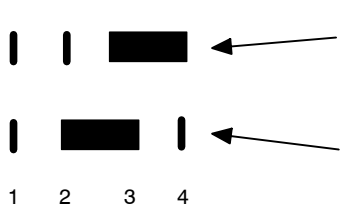
Jumper position to use the second memory window.

Board 1 Memory Identification Jumper Positions



This digit is determined by jumpers HD6, HD7, and HD8. HD6 is the least significant digit and HD8 is the most significant digit.

This digit is determined by jumpers HD4 and HD5. HD5 is the most significant digit.

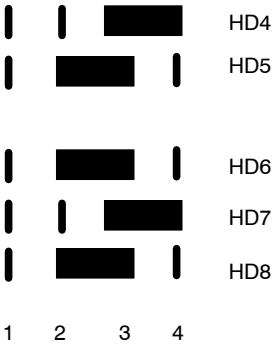


The 3–4 jumper position represents a 0 value.

The 2–3 jumper position represents a 1 value.

Never use the 1–2 jumper position.

This is the jumper position of the shipped board and represents 766**02**0 octal.



This jumper position represents 766**52**0 octal.

HD5 is set to 1, HD4 is set to 0, giving 100 binary or 4 octal.

HD8 is set to 1, HD7 to 0, and HD8 to 1, giving 101 binary or 5 octal.

Board 1 I/O Space Code Jumper Positions

Board 2 LEDs

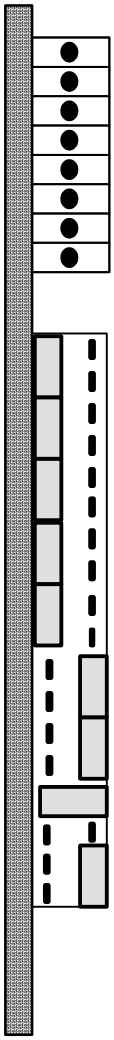
Mode	LED Indications
Power on, but not yet booted; board reset	The bottom two LEDs alternate on and off and the bottom yellow LED is steady on.
Diagnostics	The bottom red LED is steady on. The yellow LEDs blink as diagnostics are run.
Running	The green LED is steady on. The yellow LEDs blink as indicated above.

NOTE: The PeerWay address is the sum of the jumper values plus 1.

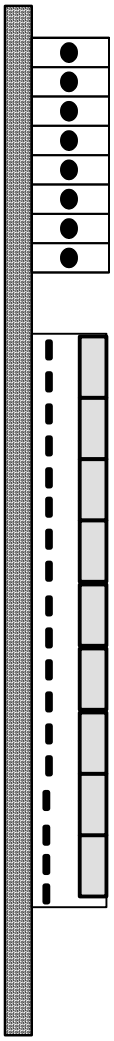
Board 2 PeerWay Address Jumpers

Jumper	Value at 1–2	Value at 2–3
J1	1	0
J2	2	0
J3	4	0
J4	8	0
J5	16	0

Diogenes Interface
TI Communications Card 1984-0408-0001



RS-232 connection



Current loop connection

Diogenes TI Comm Card Jumpering

RNI 10P53330001

NOTE: The RNI Fan assembly (10P53910001) plugs into jack J4 on the RNI power supply board. The fan is the only field-replaceable component of the RNI.

RNI LEDs

LED	Color	Meaning
HW GOOD	Green	The hardware has passed all diagnostic tests and is running normally.
HW BAD	Red	The hardware has failed one or more diagnostic tests. The RNI is not operating.
COMM	Yellow	Blinks when internal communications occur in normal operation.
PW A/B	Yellow	ON when PeerWay A is active. OFF when PeerWay B is active.
ERROR	Yellow	Indicates failure of a diagnostic test if the red LED is ON and this LED flashes. The number of flashes indicates the failed test. 1 CPU 2 ROM CRC 3 Memory Controller 4 Main Memory 5 68302 Static Memory 6 Main Memory Size 7 TRAP Exceptions 8 TEA Exceptions 9 Read/Write Latch 10 Real Time Clock 11 Watchdog Interrupt 12 Ethernet Loopback
TMSTR	Yellow	ON if the RNI is the PeerWay Tick-Master.

RNI Switches

Switch	Meaning
RESET	Resets and reboots the RNI

RNI Connectors

Connector	Meaning
CONSOLE/ SERIAL PORT 1	Connection for ASCII terminal.

RNI Jumper

Jumper	Setting	Function
HD1	10BASE2	The 10Base2 Ethernet connector is enabled.
ETHERNET	10BASET	The 10BaseT Ethernet connector is enabled.

RNI Fuse

Fuse	FRSI Part No.	Littelfuse Part No.	Bussman Part No.	Characteristics
F1	G50382-0021	273003	MSF 034.4224	2 Amp Plug-in (On the Power Supply card)

FISHER-ROSEMOUNT

RS3™
Service Quick Reference Guide

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